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JOHNE'S DISEASE.

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JOHNE'S disease is a slowly developing, chronic inflammation of the intestines which eventually causes the affected animal to scour uncontrollably, so that it becomes greatly emaciated and dies of sheer exhaustion.

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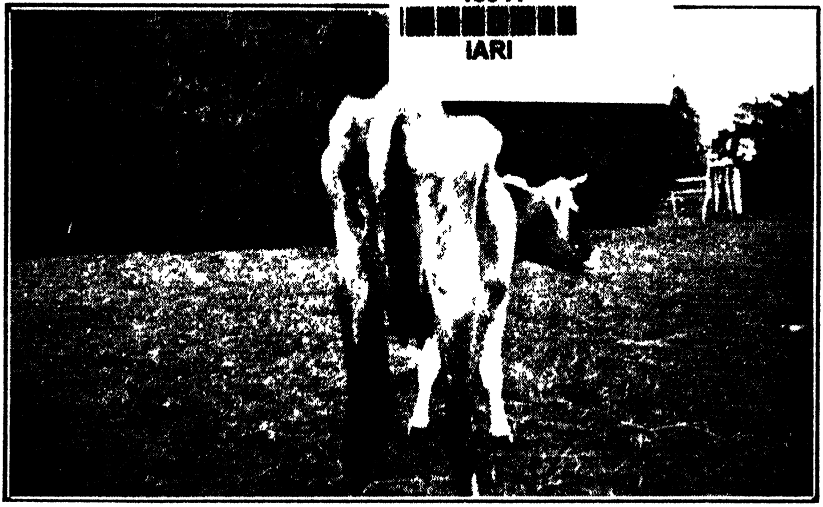

FIG. 1. TYPICAL ADVANCED CASE OF JOHNE'S DISEASE.
Note the emaciation and evidence of scouring.
(Photo kindly supplied by H. R. Dew, Stock Inspector.

Sheep are occasionally infected with the disease, goats may contract it also, and it has been recorded in a herd of deer. It seems to be a disease to which any ruminant is more or less susceptible, although cattle are the only ones commonly affected. Dairy breeds are more commonly affected than beef breeds, but that is probably due to the strain of calving and milk-production lowering their powers of res ance, and also to the fact that beef cattle are slaughtered at a ent paratively early age. It is considered that there is no differe ***do not***
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the susceptibility of the different dairy breeds. Naturally if one breed predominates in an infected country the cases will occur mainly in that breed

A point which requires stressing is that Johne's disease spreads very slowly Acute diseases, such as swine fever or foot-and-mouth disease, sweep through a herd in a few days, but that is far from being the case with Johne's disease Even on a badly infected farm it is seldom that more than three or four clinical cases -*i.e.*, cases showing recognizable symptoms—occur in any one year.

THE CAUSE.

Johne's disease is caused by a microbe that is similar in many ways to the bacillus of tuberculosis Especially does it resemble the type of tubercle bacillus that affects birds. Indeed for many years after the cause was first discovered by Professor Johne in Dresden in 1895, it was thought to be a peculiar form of intestinal tuberculosis and was called "paratuberculous enteritis."

Although there is evidence to suggest that the disease was present in Europe at least 100 years ago, and there is no means of knowing how much longer it was in existence before that, it was only in 1895 that Johne first detected the causal organism in the bowel lesions. Even then there was no proof that this microbe was really the cause, as Johne, and others who attempted it after him, were unable to grow it and consequently experimental work on the usual lines could not be undertaken It was not until 1912 that Twort and Ingram found the means of growing this bacillus in the laboratory The difficulty arose through the fact that Johne's bacillus has very peculiar growth requirements and does not grow at all on any of the media commonly used for culturing micro-organisms. In addition to that, even when a suitable medium for growth was found, the bacillus grew so slowly that only after several weeks' incubation was it sufficient to be detectable with the naked eye, whereas the majority of microbes give easily visible colonies in a few days at most Only within the last three or four years have improved media been evolved which give a visible growth of Johne's bacilli in a somewhat shorter time.

Then, too, it is possible with almost all diseases to study them by using small animals such as rabbits, mice, or guinea pigs, but Johne's disease cannot be transmitted regularly to any of these species, and this fact was, and still remains, a very serious obstacle in the way of research work.

It is necessary to mention these facts so that it may be appreciated why our present knowledge of Johne's disease has taken so long to acquire, and why even now that knowledge is far from complete.

SYMPTOMS.

The earliest symptoms shown by an affected animal are a tendency to loose bloom and to have a harsh staring coat. There is nothing in this on which a diagnosis can be based, and many other diseases, of which tuberculosis is one of the commonest, produce similar early dications of their presence But in a herd where Johne's disease is wn to occur these signs, manifested at a time when the feed con- s are such that the rest of the herd is thriving well, should always ded with suspicion.

Later there is scouring and more rapid wasting. The diarrhœa is often intermittent at first, and the cow, after scouring and losing condition for a fortnight or so, apparently recovers and puts on flesh again only to have another attack of scouring a few weeks later. The intervals between attacks of diarrhœa become shorter, and finally persistent scouring sets in, quickly reducing the animal to a skeleton, and death from weakness and exhaustion puts an end to the case.

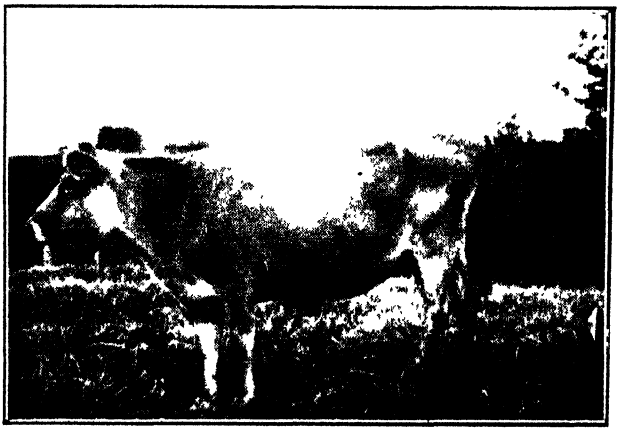

FIG. 2. A CASE OF JOHNE'S DISEASE.

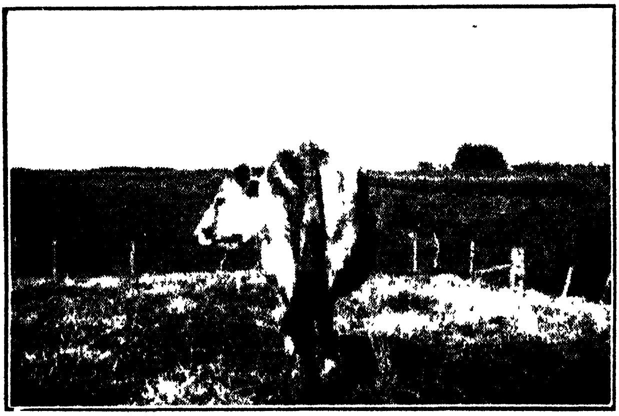

FIG. 3. ANOTHER ILLUSTRATION OF A CASE OF JOHNE'S DISEASE.

In other instances an animal may show no sign whatever till persistent scouring occurs, when it quickly wastes and may die in two or three weeks. This is fairly common just after calving in affected cows, and the rapidity with which some such cases will waste and die under the effects of the continuous scouring is remarkable.

In the more slowly developing type of case, with intermittent attacks of diarrhœa, there are two symptoms which, *while they do not invariably appear,* are useful aids to diagnosis. One of these is the appearance of a dropsical swelling under the throat and jaw and the other is a tendency to waste more markedly about the hindquarters, especially the thighs and buttocks, than in other parts of the body. Below are two photographs of a case which demonstrates these two points very clearly.

The affected animal shows no sign of illness other than the wasting and diarrhœa. She is not feverish and continues to eat. Naturally her milk-yield falls away, and as a result of the diarrhœa and consequent loss of fluid from her body there is generally great thirst.

The symptoms that have been briefly described here are not shown, unfortunately, till many months, and sometimes several years, after the animal first contracted the infection. The incubation period in Johne's disease—that is to say, the interval that elapses between the time infection takes place and the time when symptoms are first shown—is seldom less than one and a half years and is often much longer than that. Consequently symptoms are not often seen in very young animals; wasting and scouring frequently occur in yearlings, but this is almost invariably due to worms in the fourth stomach and intestine, not to Johne's disease. It is in animals from two years old upwards that scouring *for no apparent reason* should be considered suggestive of Johne's disease.

TREATMENT.

There is no known cure for this disease. If treatment for diarrhœa is given during the stage when intermittent scouring is taking place, it may seem to have a good effect, but actually the diarrhœa would have ceased for a time in any case, and will later occur again in spite of any treatment. In countries where cows are of higher beef value than they are here a form of treatment is sometimes used that temporarily checks the scouring and enables a little condition to be put on the beast by special feeding before it is disposed of to the butcher, but, as stated above, there is no cure for Johne's disease, and money spent on medicines is money thrown away. In addition to that it is merely continuing to endanger the rest of the herd to keep an infected animal alive.

PREVENTION.

A beast that is scouring with Johne's disease passes large numbers of the causal organism in its droppings. Hence the pasture and drinking water of the other cows are apt to be infected, and in this way the disease is spread amongst them. Unfortunately Johne's bacillus can remain alive in soil and water for a long time. The exact time that it can survive is not known, and undoubtedly it varies according to the condition of warmth, moisture, and so on, that the bacillus is exposed to, but under conditions which favour it it can probably survive for between one and two years.

Swampy, low-lying areas are considered to especially favour the survival of the bacilli deposited on them by infected cattle, and to be important sources of fresh cases of the disease on affected farms. It is essential that such areas be either drained and heavily limed, or, if this is impracticable, fenced off completely. Apart altogether from Johne's disease swampy areas tend to harbour infectious diseases of all sorts—both bacterial and parasitic—and to deal with them in one or other of these ways is always highly desirable.

There is a widespread belief in Britain and elsewhere that infection is more readily conveyed to cattle by drinking water that is contaminated with Johne's bacilli than by grazing, and this is probably correct. Thus ponds, swampy pools, and other such surface waters which the cattle can stand in as well as drink from are especially dangerous, and should be replaced wherever possible by concrete drinking-troughs, which are less liable to contamination and can be kept clean. The farmer seldom realizes the potentialities of such contaminated water-supplies for conveying disease amongst his stock. It does not apply only to Johne's disease, but to tuberculosis and infectious diseases generally.

Chain-harrowing paddocks that have harboured infected cows is a most useful aid in control, as the beasts' droppings are then broken up and the sun is afforded a chance to dry them thoroughly and sterilize them. Sunlight is one of the most powerful disinfectants, but it needs to be given a chance

Heavy dressings with burnt lime are to be recommended. They are considered in France, where Johne's disease is very common in certain areas, to have given good results, and in the Channel Islands also the liming of infected pastures is claimed to have been most beneficial in reducing the incidence of fresh cases How burnt lime produces the effect claimed for it is not known, but it may act through some effect on the soil rendering conditions in it unfavourable for the bacillus so that it dies out.

It will be apparent that while these preventive measures have a highly important part to play, something more is required if much real headway is to be made Especially is there need for some means of detecting animals in the early stages of the disease before symptoms are shown. Unless this can be done we have very little hope of controlling the spread of the disease through the country, because of the fact that an infected animal may be capable of infecting others for some years before showing symptoms itself. During those intervening years it may carry the infection into several herds An instance of this sort was brought to the writer's notice recently: A pedigree bull was sold by A to B Some four years later Johne's disease began to appear in B's herd In the meantime the bull had been sold to C. About three years after his arrival, Johne's disease appeared in C's herd, and eventually the bull himself died of it. While there is no actual proof, inquiry provided strong circumstantial evidence that this seemingly healthy bull had carried the disease into both herds. Fortunately we now have a test which can be used to detect the presence of Johne's disease in the early stages

THE JOHNIN TEST.

There is no need here to discuss the development of this method of testing for Johne's disease. It will suffice to say that it is done by injecting small quantities of Johnin (similar to tuberculin) into the animal's skin and noting the result It is very similar to the modern method of testing for tuberculosis. The test is completed in seventy-two hours, and does not affect the cow in the slightest. This latter point is mentioned, as an owner sometimes expresses a fear lest the application of the test should put a cow off her milk.

It is not as reliable as the tuberculin test, and a great deal of skill and experience is required to apply and interpret the results of the test properly, but in the hands of an experienced veterinarian it can give the greatest assistance in detecting early cases of the disease.

JOHNE'S DISEASE IN NEW ZEALAND.

There can be no doubt that it was introduced here in infected, but apparently healthy, imported cattle. That is how it has reached all new countries, and considering what has been said above regarding its lengthy incubation period, coupled with the fact that until recent years there was no means of detecting such animals, it is not surprising that it should have been spread in that way.

The first case that was ever shown to be Johne's disease in New Zealand occurred in an imported cow in 1912. The animal was destroyed and instructions issued to field officers that specimens from any animal showing suspicious symptoms were to be sent to the Wallaceville Laboratory for examination That instruction was issued because it was considered very probable that other imported animals besides the one detected and killed might well have brought the disease in during previous years

As a result of this a number of specimens were received from time to time and examined at Wallaceville, but none was confirmed Nevertheless the disease must have been present, for in 1928 specimens were received from a suspicious cow near New Plymouth, and examination showed it to be a well-marked case of Johne's disease This occurrence reawakened interest in the disease It was at once realized that this was unlikely to be the only case, and inquiries were immediately started. They revealed that a condition of this sort had occurred on several farms, but the owners had not reported the affected animals to the Department, as they attributed the scourings to various non-infectious causes, such as a "chill," unsuitable food, retention of part of the afterbirth, ragwort poisoning, and so on, and, while the history of the cases aroused suspicion, there was no definite evidence that they were, in fact, cases of Johne's disease That being so a search had to be made for actual cases, and it was only after considerable time that these were eventually found.

Johne's disease was scheduled under the Stock Act in 1931 in order to give departmental officers the requisite authority to slaughter infected animals and pay compensation for them. Since the rediscovery of Johne's disease in 1928 the Department of Agriculture has been active in its inquiries concerning the disease both in this country and abroad, and has taken advantage of all fresh information that has come to light, particularly as regards methods of testing cattle to detect the presence of the disease before symptoms are shown.

At the present time in New Zealand we know of its presence on several farms in Taranaki and the Waikato, and it is likely that it is also present to a slight degree, and as yet undetected, in certain other dairying districts.

The action the Department is taking to check the spread of the disease as far as possible may be outlined briefly as follows:—

To protect the whole Dominion from Imported Infection.—All imported cattle, from whatever country, must be accompanied by a veterinary certificate that they passed the Johnin test prior to shipment.

To protect the South Island.—In view of the disease being as yet unknown in the South Island, all dairy cattle going from the North Island to the South Island must pass the Johnin test applied by a Government Veterinarian before they are allowed to leave the farm of origin.

To limit the Spread of Infection in the North Island – The best means of accomplishing this has been the subject of long and very careful consideration of all aspects of the question. It is a far more complicated matter than may be easily realized and the Department has no intention of binding itself to any hard-and-fast policy. It can be said at once that there is not now, nor will there be, any intention of slaughtering out infected herds Such a measure, with full compensation to the owner, would be the best means of all if we knew definitely that the disease was limited to a few herds, but the time when any such action were possible has long since gone past

It is the intention to interfere as little as possible with the normal practice on affected farms Apart from a desire to inflict as little hardship as possible on the farmers concerned, the Department is actuated also by the fact that any drastic action would inevitably lead to concealment of the presence of the disease, and although slightly more drastic action than it is intended to take might be more effective on the farms where it could be put into operation, there would in reality be little to gain and a great deal to lose by being too severe.

The action now being gradually brought into operation is that affected herds are to be tested with Johnin at half-yearly intervals and the reactors slaughtered Compensation will be paid in accordance with the provisions of the Stock Act The owner must notify the Department of any intending sales of stock, and these will, if considered necessary, be tested again prior to sale Inspection of the farm itself will be made and advice given on general lines of prevention, including management of the herd and matters such as draining and liming of pastures

For the past two years this line of action has been in operation in two grade herds in Taranaki, and the progress made with this experimental trial warrants the hope that with the co-operation of the farming community the method will go a long way towards checking the spread of the disease.

Farmers having suspicious cases are urged to report them without delay to the nearest office of the Department. It is obviously in their own interests as well as to the advantage of the dairy industry as a whole that they should do so.

While the normal high quality of New Zealand meat has been well maintained, it seems to behove us to ask whether this suffices in view of developments in the world's meat trade It probably may be said with truth that quality is of more value in meat-marketing now than it ever was before. Some of our competitors in the world's meat-markets assiduously have been increasing not only their output but the quality of that output In regard to lamb, for instance, the point may have been reached where there is danger that our supremacy in regard to quality—a supremacy which is so valuable to us—may be challenged The New Zealand sheep industry cannot face such a possibility with equanimity Fortunately there is no clear reason why its previous valuable eminence in respect to quality of lamb and mutton cannot be maintained – *Annual Report, Director-General of Agriculture*

POTASH TOP-DRESSING OF AUCKLAND PASTURES.

RESPONSE FROM POTASH AT WAIHI.

J E. BELL, Instructor in Agriculture, Pukekohe.

(Concluded.)

RESPONSES IN OTHER DISTRICTS.

IN other districts responses to potash are not so consistent, and cannot be confined to one soil type or to one locality. Nevertheless, isolated striking responses have been obtained on all soils—on peat, on sand, loams, clays, and silts. There is little doubt that as experimental work progresses soil types in some localities will be recognized to be potash-deficient to some degree. In different localities and soils the pastures vary somewhat, but the method of improvement by potash is the same in principle.

On the gum-land soils of the northern parts of the province a common poor sward is brown-top dominant. Common clovers in such a sward are *Lotus* species and white clover. One observational trial at Waimauku, Waitemata County, on such a soil was laid down on a dominant-brown-top sward with much Chewings fescue and rib-grass and a scarcity of clovers. A casual inspection did not reveal the presence of better grass species in the sward which was improved in the following sequence by the use of superphosphate plus lime plus potash. First there was an increased growth of *Lotus hispidus*, *Lotus major*, subterranean clover, and white clover. The ascendancy of the subterranean clover was marked first, and later the white clover overtopped the subterranean clover and subdued it. Improvement in the better grasses did not occur until the white-clover dominant stage was reached, when many plants of rye-grass, paspalum, cocksfoot, and crested dogstail appeared prominently in the sward. The Chewings fescue has almost entirely disappeared from view, but the more virile brown-top is still there, although not prominent, and has changed in appearance from a dull hue to a healthier deeper green colour, after only two years. The difference between the superphosphate plus lime plus potash plot with its thick carpet of white clover and vigorous rye-grass and crested dogstail and paspalum, and the superphosphate plus lime plot with its less vigorous sward of clovers and inferior grasses is quite striking. Other plots included one treated with lime and potash, and at one of the early inspections it was noticed that this plot had arrived at a stage when subterranean clover was the dominant clover, while the superphosphate plus potash plus lime plot had arrived at the stage where white clover was in the ascendant. The lime plus potash plot did not get much beyond the subterranean-clover-dominant stage and white clover did not flourish through phosphate deficiency. Consequently there was not much further improvement in the lime plus potash plot beyond the brown-top - subterranean - clover stage. The vigorous white-clover - dominant stage could only be reached by the use of superphosphate plus potash plus lime. Without a thick vigorous sole of white clover the mat of brown-top remained unchallenged by better grasses. Superphosphate and lime alone or combined could not bring

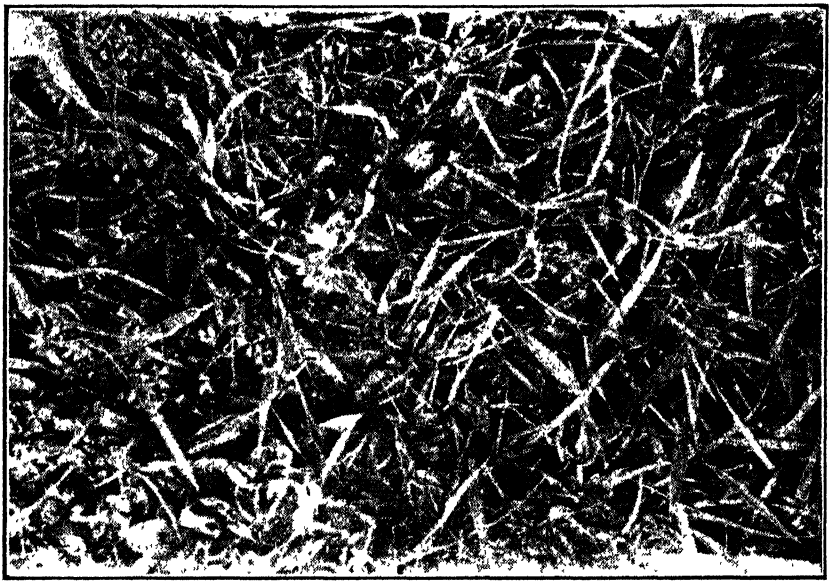

FIG. 5. NO POTASH (EXPERIMENT NO. 306)

A sward of catsear, lamb's tongue, and other flat weeds and stunted suckling clover, with some weak rye-grass, fog *Poa pratensis* (in flower), and cocksfoot and sweet vernal Where is the white clover? [*Photo by H Drake.*

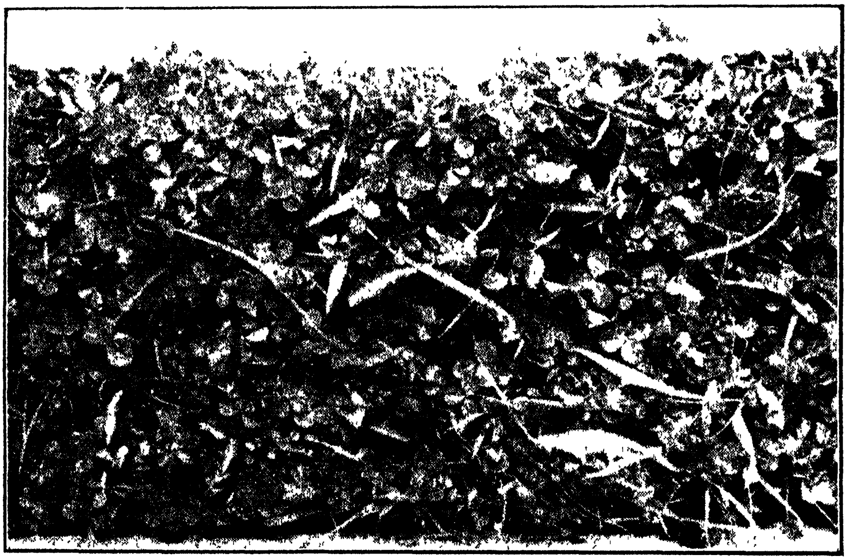

FIG. 6. POTASH (EXPERIMENT NO. 306)

Compare with Fig. 5 taken from sward alongside. Note the increase in suckling clover, and white clover has swamped the weeds. Note, further, how the white clover has miraculously appeared and is shading the suckling clover, the vitality of which, now at its height, will diminish due to lack of sunlight

[*Photo by H. Drake.*

about this much-desired white-clover growth. The effect of lime in addition to superphosphate, or superphosphate in addition to lime, was as nothing compared with their effect where potash was also used. Thus lime in addition to superphosphate gave only a slight benefit, whereas lime in addition to superphosphate plus potash made quite an appreciable difference. In the same way superphosphate in addition to lime showed minor differences, while superphosphate in addition to lime plus potash gave an almost magical improvement. Potash used alone was useless or perhaps detrimental to a very slight degree. Used with lime its effect was slight and with superphosphate quite good, but not to be compared to where used with superphosphate plus lime. This trial was the first one in which the effect of potash was noted on a sward deficient to a large degree in potash, and most of the principles of potash response which were demonstrated there have since been found to apply equally to other swards on other soils, including the sandy loams of Waihi.

On a loam soil, apparently the result of a volcanic ash shower, at Runciman, Franklin County, the potash has increased by 100 per cent. the extent of the rye-grass, white and subterranean clover cover of the ground and has decreased the rib-grass, where it was applied in addition to superphosphate and lime. Here the effect of potash to the eye was very small compared with the effect at Waimauku, for the superphosphate plus lime plot contained quite a fair sole of rye-grass and clover. Potash here, though very useful, could not be claimed to be definitely payable as a top-dressing. There are many trials where potash effects small increases and where its use may not be payable. At Runciman as at Waimauku, potash was most effective where the lime and phosphate deficiences had been met, and it also added to the effectiveness of lime and superphosphate.

On peat land at Kaipaki, Waipa County, potash has greatly improved the pasture sward: applied to a poor paspalum sward it has greatly increased the white-clover, suckling-clover, and *Lotus major* growth: white-clover growth was most improved on the superphosphate plus potash plots. At Orewa, Waitemata County, on a sandy soil overlying an ironstone pan, potash showed early improvement in the growth of *Lotus major* and white clover. Here the speed and the extent of further improvement may be limited by lack of soil moisture in summer due to the iron pan. On one trial at Mauku, Franklin County, on basic volcanic soil, a trial has shown responses in white-clover growth on the potash-treated plots. The plot was placed on a field subjected to much cutting for ensilage. Another trial at Ramarama, Franklin County, on a similar soil, has shown also a very strong potash response in increased clover vigour on a field subjected to much cutting for hay. Fields subjected to much cutting for hay or silage appear liable to suffer from potash deficiency.

A trial at Waiau Pa, Franklin County, on a gum-land silt, shows the inefficiency of potash where a large lime deficiency is not first corrected. With lime—and phosphates—potash has given increased growth of white clover; without lime potash proved detrimental. This brings out the important point that on lime-deficient soils potash may prove detrimental if the lime deficiency is not first corrected; this sometimes occurs both on soils that do respond to potash and those that do not.

Of course, on soils where there is little or no lime deficiency the use of potash without lime can make full improvement Thus, on one other trial at Waiau Pa, on a lighter soil not very responsive to lime, potash is equally effective in increasing white clover on both limed and unlimed areas.

Besides trials showing strong and payable potash responses, there are many trials where it shows to a very slight and apparently unpayable extent In these trials phosphates or phosphates plus lime dressings are sufficient for white-clover establishment, and continued growth and high production can be obtained without potash. On a large number of trials potash shows no response whatever.

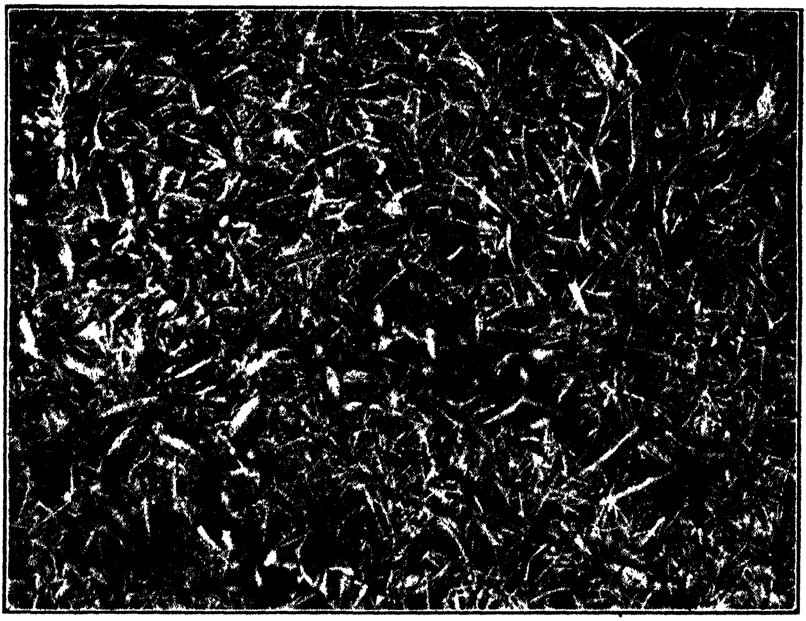

FIG 7 NO POTASH (EXPERIMENT NO 302)

A sward of sweet vernal, weak rye-grass, and rib grass, with some weak white clover *Lotus major*, and cocksfoot and hair-grass Photo taken in winter Compare with Fig 8

[Photo by H. Drake

All the observations in this article are based on the effect of annual dressings of 30 per cent. of potash salts at 2 cwt. per acre. These are heavy applications, made purposely so that soils deficient in potash to the slighest degree can be more easily detected. Yet even so, in some trials the increases due to potash appear so great that these heavy and costly applications appear payable. The first task is to locate soils responsive to potash. The next is to lay down, on potash-responsive soils, trials devised to show the effect of smaller amounts of potash than 2 cwt. so that fairly definite advice can be given as to the economic quantity to apply.

Thanks are due to the numerous farmers who placed fields at the disposal of the Department for the experiments.

Summary of L.P.K. Trials at Waihi and other Localities.

Plots are pegged out in farmers' pasture fields, and the different plots are top-dressed with different treatments or combinations of treatments. The common type of trial is called the L.P.K. observational trial, which is laid down to locate the responses to carbonate of lime and 30 per cent. potash salts. In the L.P.K. trial the lime and potash are applied at heavy rates, so that differences can be more readily discovered, the lime being applied at the rate of 1 ton per acre at laying-down and at 5 cwt. per acre thereafter annually, the potash at 2 cwt. per acre annually, the phosphate (superphosphate) being applied at the normal rate of 3 cwt. per acre annually. The L.P.K. trial comprises eight plots as follows :—

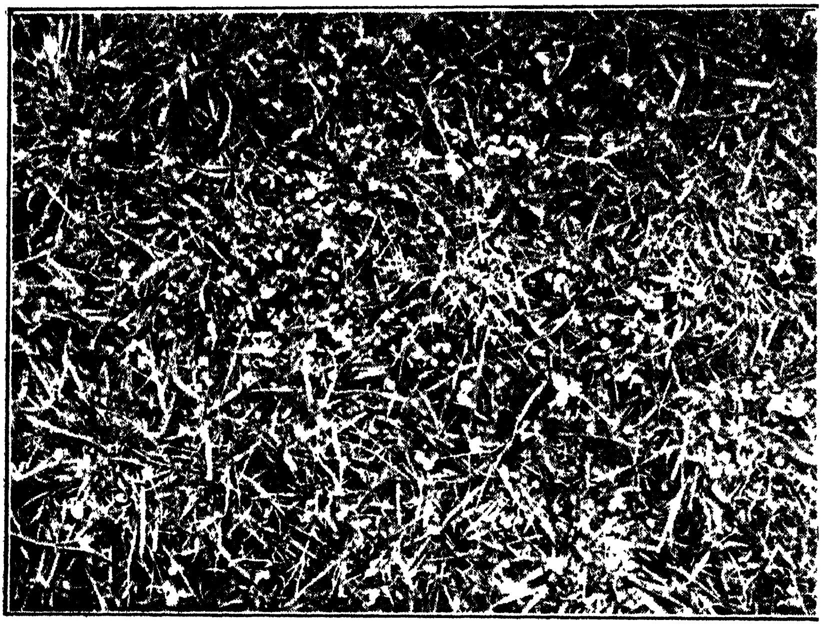

FIG 8. POTASH (EXPERIMENT NO. 302).

Taken in winter when growth is not vigorous, nevertheless the photo shows the enormous improvement caused by potash As the white clover assumes charge the previously stunted and inconspicuous rye-grass grows vigorously, poor-producing grasses and weeds, such as hair-grass, catsear, and lamb's tongue, disappear. The better grasses appear more prominently in the sward because they grow better, and in tillering occupy wider territory.

Note the prominence of rye-grass and elimination of hairy flat weeds and *Lotus major*, and almost complete eradication of rib grass. Sweet vernal is still present, but suckling clover, which was prominent shortly after the application of the potash, has almost entirely disappeared. [*Photo by H. Drake*

(1) No manure.
(2) Superphosphate.
(3) Superphosphate plus potash.
(4) Potash.
(5) Lime.
(6) Lime plus superphosphate.
(7) Lime plus superphosphate plus potash.
(8) Lime plus potash.

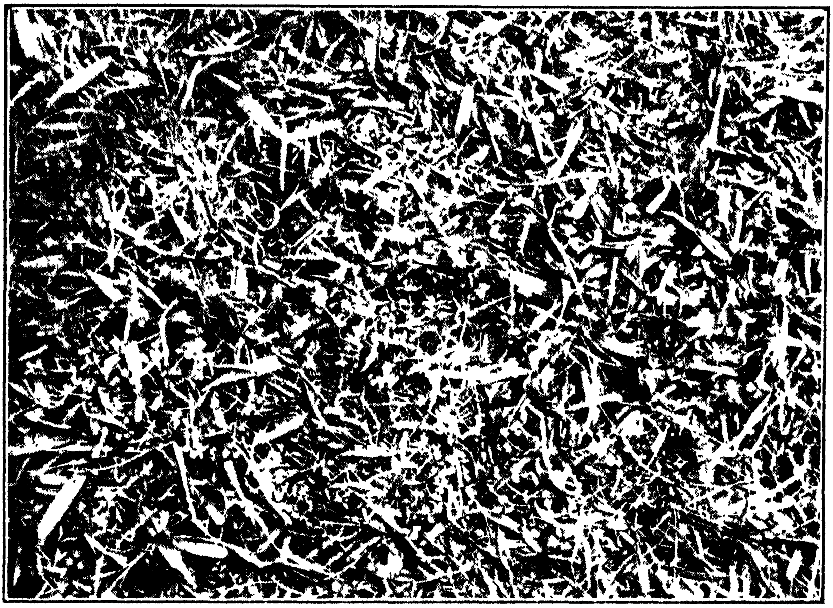

FIG. 9 SUPERPHOSPHATE (EXPERIMENT NO 389)

A poor sward of paspalum and stunted suckling and white clovers on peat (Kaipaki peat loam, Waipa County) Superphosphate alone has not increased clover-growth [Photo by H Drake

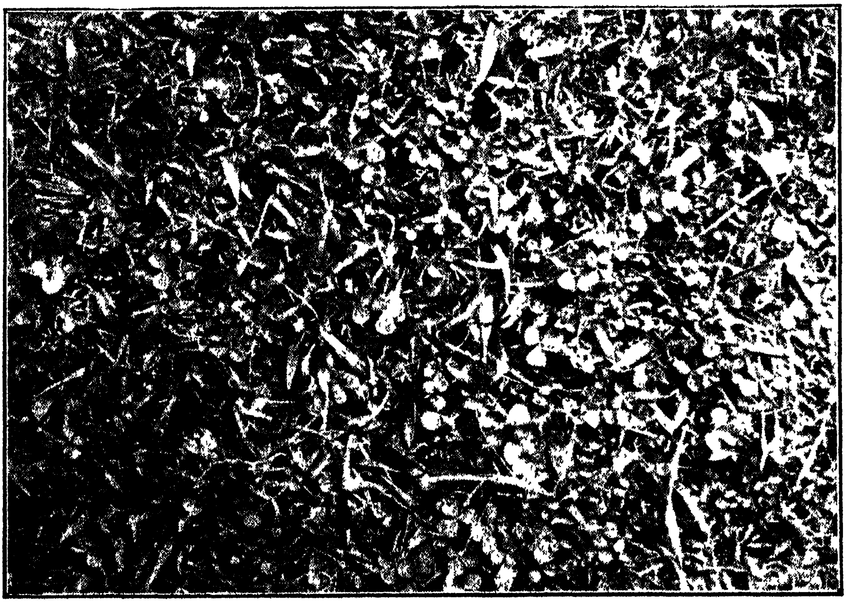

FIG. 10 SUPERPHOSPHATE PLUS POTASH (EXPERIMENT NO. 389).

Superphosphate and potash together have greatly improved white-clover growth. (See Fig 9) [Photo by H Drake.

The trials are laid down in duplicate. Comparisons are effected by observations carried out every three months, and the effects of the different treatments are noted thereby every season of the year. Not only is the effect noted, but the degree of the effect is recorded by numerals 1 to 5, indicating the superiority to the untreated plot. Thus, 0 indicates no improvement or detriment over the untreated plot, 1 slight, 2 fair, 3 good, 4 very good, and 5 excellent responses by the particular treatment.

The following table shows the responses on many of the trials in the Auckland Province where good potash responses have been obtained, and of all the trials at Waihi that have been down two years.

Trial.	Locality.	Soil Type.	Response to			
			Superphosphate.	Superphosphate plus Potash.	Lime plus Superphosphate.	Lime plus Superphosphate plus Potash.
16/1/299	Waihi	Sandy loam	0	3	0	3
300	,,	,,	1	2½	1	2½
301	,,	,,	0	3	0	3
302	,,	,,	½	4½	1	4½
304	,,	,,	½	3	½	3
306	,,	,,	1	3½	1½	4½
303	,,	Alluvial loam	2	2	2	2
305	,,	,,	1	1	1	1
307	,,	Peat over alluvial	½	1	½	1
151	Kaihere	Deep peat	0	1	1	3
245	Patumahoe	Loam	1	2½	1½	2½
246	Ramarama	Clay loam	½	3	½	3
250	Waiau Pa	Clay	2	1	2½	4
262	Mauku	Loam	½	3	½	3
289	Waiau Pa	Clay loam	0	2	1	3
311	Ramarama	,,	½	2	1	3
389	Kaipaki	Loamy peat	0	3	0	3
261	Tauranga	Sandy loam	1½	2½	2	3½
203	Matamata	,,	2	4	3	3½
147	Waimauku	Silt	1½	3	2	5
220	Orewa	Sand	1	3½	1	3½
432	Ruatangata	Loam	2	2	3	4½
383	Kerikeri	,,	½	2	2½	2½
328	Te Kuiti	Sandy loam	½	2	1	2½
239	Te Kowahi	,,	½	2	1	3
342	Rukuhia	,,	½	2	1	2½
376	Ngahinepouri	Coarse sandy loam	½	2	1	2½
131	Runciman	Loam	1½	2	3½	5
127	Waiuku	,,	3½	4	4½	5

THANKS.

Thanks are due to Mr. P. W. Smallfield, Fields Superintendent, Auckland, and to Mr. J. W. Woodcock, Crop Experimentalist, Wellington, for their very helpful criticism of this article.

In accordance with the provisions of section 7 (2) of the Noxious Weeds Amendment Act, 1934, the Franklin County Council has assumed the administration of the Noxious Weeds Act, 1928, and its Amendments.

SPRAY SCHEDULE FOR CONTROL OF PRINCIPAL ORCHARD DISEASES AND PESTS.

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INCREASED and more intensified research is being conducted into the problems of disease and pest control in all countries of the world, including this Dominion. The Department is keeping closely in touch with the results which are being obtained from the comprehensive trials which are being carried out here and overseas with a view to further improving the spray schedule.

For the sake of clarity, in the following statement the treatment recommended for the principal pests and diseases will be dealt with in groups as far as practicable.

CHEWING INSECTS.

For such chewing insects as codling moth, leaf-roller caterpillar, pear or cherry slug, and bronze beetle, lead arsenate at a dilution of 1½ lb. to each 100 gallons water is recommended at the following periods:—

Period of Treatment	Codling Moth.	Leaf-roller Caterpillar	Pear or Cherry Slug	Bronze Beetle.
About 1st November	Petal-fall 75 per cent petals fallen	Petal-fall	When slug makes its appearance	Petal-fall.
About 10th November	10 days later	10 days later	Repeat if necessary 14-21 days later	10 days later.
About 28th November	14-18 days later	14-18 days later		14-18 days later
About 16th December	Ditto ..	Ditto		Ditto
About 4th January ..	14-21 days later	14-21 days later	..	..
About 25th January	Ditto ..	Ditto ..	..	..
	Continue on mid-season and late varieties in localities where late infection may be expected	Ditto	..	..
About end February	..	Ditto ..	..	..

For the satisfactory control of leaf-roller caterpillar the sprays require to be continued later into the season than it is customary to apply them. In localities where the caterpillar appears earlier than petal-fall spray at its first appearance. The foregoing programme has been compiled with a view to ensuring that an adequate coverage is maintained upon the fruit and foliage. It is the practice in some Nelson orchards to make as few as four applications of lead arsenate in the season.

The following analysis of results obtained in official experiments carried out in the Hawke's Bay District and at the Nelson research orchard indicates the value of spraying with lead arsenate 1½ lb. per 100 gallons spray for the control of codling moth, leaf-roller caterpillar, and bronze beetle :—

District.	Lead Arsenate Number of Applications.	Wormy Apples.	Stings.	Leaf-roller.	Bronze Beetle.	Variety.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Hastings ..	Check, Nil ..	16·0	1·4	14·9	8·5	Cox's
	Test, 6 ..	0·6	7·6	0·3	Nil	
Nelson ..	Check, Nil ..	5·5	9·9	41·0	No record	Sturmer.
	Test, 5 ..	0·05	0·8	2·6		

In the Hastings trial 2 gallons spray applied per tree. In the Nelson trial 2¼ gallons spray applied per tree.

Codling Moth is not difficult to keep under control where standard measures against it are adopted. Most injury is occasioned by stings or bites.

Bandaging is a valuable supplementary means of capturing the codling grub. Bands should be applied to the trees by the middle of November, and should be removed carefully in the winter so that the grubs lodged against the bark of the tree will not be lost on the ground. Chemically treated bandages should be burnt, while sacking bandages should be carefully examined and all larvæ found therein killed and the bandages replaced not later than mid-November. Rough bark and crevices should be examined for larvæ.

Other means of control are treatment of picking-cases, examination of packing-sheds and equipment for grubs—picking from the tree or gathering without undue delay fruits which have fallen to the ground, and destroying the grubs by feeding fruit to stock, submerging it in water for a day, or destroying it.

As the result of thorough and timely spraying, together with these supplementary measures, codling moth should not prove troublesome to combat.

Leaf-roller Caterpillar.—The moth is usually in flight in November, December, January, and February period, and in some years into March. As the foregoing results show, spraying is effective against this pest on apple-trees. Where severe injury obtains it is probably due to absence of adequate coverage on the young growth and foliage and on the fruit, or to the discontinuing of the arsenate sprays too early.

Bronze Beetle.—In addition to spraying, the land should be cultivated up to the orchard boundary, and, in addition, the soil about the trees should be stirred at "petal-fall" period : this latter measure is important where the beetle is troublesome.

Pear or Cherry Slug.—No trouble is experienced on pears where lead arsenate is applied to control the codling moth. On cherry trees one, but at the most two, applications of lead arsenate will control this pest.

SUCKING INSECTS.

For sucking insects, such as red mite, scales, aphides, apple-leaf hopper, mealy bug, the schedule of spraying recommended is—

Period of Treatment.	Red Mite, Mealy Bug.	Scales.	Aphides.	Apple-leaf Hopper.
Dormant (July)	.		On stone-fruits: Tar-oil emulsion (1–15)	.
Bud movement (about 10th September)	Winter oil, 3 per cent.	Winter oil, 3 per cent (San Jose scale, 5 per cent.)	Pip-fruits: Winter oil, 3 per cent against woolly aphis	.
Early summer .	Lime-sulphur at appropriate dilutions	Lime-sulphur at appropriate dilutions when crawlers on move	Lime-sulphur at appropriate dilutions (nicotine sulphate 1–800 may be added)	Add nicotine sulphate 1–800 to spray should nymphs appear. Repeat 18–21 days later
January and February	Summer oil, 1·5 per cent.	Summer oil, 1·5 per cent	Summer oil, 1 per cent, plus nicotine sulphate (1–800)	Summer oil, 1·5 per cent, plus nicotine sulphate (1–800).
10 days later .	Ditto . Repeat if necessary	Ditto . .. Repeat if necessary	Ditto Repeat if necessary	Ditto Repeat if necessary.

NOTE.—For mealy bug control nicotine sulphate 1–800 should be added to summer-oil sprays.

It is not advisable to apply oils until at least fourteen days have elapsed preceding or following sulphur or lime-sulphur sprays. If the trees are suffering from drought conditions the effects of applying an oil spray to the fruit will be to accentuate the lack of depth of colour in the fruit. In seasons of normal rainfall oil has the effect of enhancing the colour of the fruit. The application of tar-oil sprays should be confined to the "dormant" period. If this period has passed tar-oil should not be applied.

Red Mite.—This so far has been proved to be one of the most difficult pests to control. If over-wintering eggs are at all prevalent, it is advisable to apply winter oil (preferably quickly breaking emulsion type) at bud-movement. Thorough spraying to cover the whole surface of the tree is essential to success. During early summer lime-sulphur sprays should keep mite reasonably under control. Towards the end of January and early February apply summer oil (1–80), two applications at a ten-day interval. If live mites are still in evidence, apply one further application. Autumn females lay a phenomenal number of over-wintering eggs. If oil sprays are applied at the correct period approximating the time the commencement of laying of over-wintering eggs—which, by the way, varies from season to season—a complete kill can be obtained and no winter oil need be applied in the following spring.

Scales on pip and stone fruits in carefully tended orchards give little trouble.

Aphides.—Tar-oils applied during dormancy have given good results as an ovicide against green-aphis infection on peach-trees in the Alexandra district.

Woolly aphis during the past five to seven years has again become a troublesome pest in the late summer, necessitating the application of sprays to keep it in control due to late appearance in the season of the natural enemy (*Aphelinus mali*).

Apple-leaf Hopper.—This pest is readily controlled if control sprays are applied while the hopper is in the " nymph " stage. If, however, it is neglected and allowed to reach the winged stage it will devitalize the foliage and seriously arrest the growth of the immature fruits. The hopper, where established, makes its appearance at two periods, November-December, and March, which is usually the most severe infection.

Mealy Bug.—This pest is difficult to control, particularly on pear-trees. Winter Nelis variety is particularly susceptible.

BLACK SPOT AND POWDERY MILDEW.

For black spot and powdery mildew the schedule of spraying recommended is —

Period of Treatment.	Spray.
Green-tip (about second week in September)	Bordeaux mixture (5-4-50) or lime-sulphur (1–30).
Tight-cluster . . .	Lime-sulphur (1–75).
Pink	Lime-sulphur (1–150).
Petal-fall (about 1st November)	Lime-sulphur (1–150) plus colloidal sulphur (2–100).
10 days later	Lime-sulphur (1-150) plus colloidal sulphur (2 100)
14-18 days later (about 28th November)	Lime-sulphur (1–150) plus colloidal sulphur (2–100).
14-18 days later . . .	Lime-sulphur (1–150) plus colloidal sulphur (2–100).
14-21 days later (about 4th January	Lime-sulphur (1–180) plus colloidal sulphur (2–100).
14–21 days later	Lime-sulphur (1–180) plus colloidal sulphur (2-100)
Continue if necessary	

NOTE.—Lime-sulphur dilution refers to specific containing 15 per cent. polysulphide content, calculated on basis of weight.

Black Spot.—The first five sprays are important in the control of both black spot and powdery mildew. The first and second are particularly important in black-spot control. On varieties susceptible to spray russet, Bordeaux should not be applied later than the green-tip period. To assist in minimizing ascospore infection in localities where black spot is prevalent, it is advisable to plough the land deeply in the autumn to bury the leaves, and to postpone further working of the soil until after petal-fall period. The summer (pepper spot) infection is particularly troublesome in some localities, and should not be neglected. Its appearance follows closely upon periods of increased rain or dews.

The following analysis of results of official experiments carried out in the Nelson research orchard indicates the effectiveness of the base sprays :—

Treatment	Dates of Application.	Percentage of Fruit affected with Black Spot.
Cox's Orange—		
Check, Nil ..	..	71·44
Lime-sulphur—		
1–28	29 Sept .. .	1·58
1–56 . . .	12 Oct ..	
1–170 . ..	23 Oct., 9 Nov., 25 Nov., 28 Dec	
Dunn's		
Check, Nil .	..	79·21
Lime-sulphur		
1–28 . .	29 Sept . .	3·78
1–56 .	12 Oct .	
1–170	23 Oct., 9 Nov., 25 Nov., 28 Dec	
Delicious		
Check, Nil	..	78·83
Bordeaux 5-4-50 and 3-4-50 .	29 Sept., 13 Oct .	8·83
Bordeaux 5-4-50 and 3-4-50, followed by lime-sulphur 1-170 plus colloidal sulphur 2–100	24 Sept., 13 Oct., 27 Oct., 10 Nov., 27 Nov., 29 Dec	0·86
Sturmer		
Check, Nil	.	51·02
Bordeaux 5-4-50 and 3–4–50 .	25 Sept., 13 Oct ..	6·19
Bordeaux 5-4-50 and 3-4-50, followed by lime-sulphur 1-170 plus colloidal sulphur (2–100)	29 Sept., 13 Oct., 27 Oct., 10 Nov., 27 Nov., 29 Dec	0·09

NOTE.—Lime-sulphur in above table refers to a specific containing 19 per cent. polysulphide content, calculated on the basis of weight.

In the Stoke area of the Nelson District blackening of the skin is experienced with Winter Nelis pears to which Bordeaux is applied while the young fruits are forming. It is believed that this trouble is due to Bordeaux injury, as on pears of Winter Nelis where reduced dilutions of Bordeaux are used the blackening is much less severe, and where lime-sulphur is applied the trouble is not in evidence.

The following is a result of treatment of pears for control of scab :—

Result of Treatment for Pear-scab Control on Winter Nelis Pears.

Treatment	Number of Applications.	Percentage of Fruit affected.	Remarks (Dates of Spray Applications, &c.).
Check	..	58·53	Spring and summer infection.
Bordeaux (5–5–50), (3–5–50), (1½–5–50), (1½–5–50)	4	2·00	8 Sept., 18 Sept., 2 Oct., 16 Oct
Bordeaux (5–5–50), (1½–5–50), (1½–5–50), (1½–5–50)	4	0·35	8 Sept., 18 Sept., 2 Oct., 16 Oct.
Check	..	90·85	Spring and summer infection.
Lime-sulphur 1 per cent., 0·2 per cent., 0·1 and colloidal sulphur 0·1 and colloidal sulphur 2–100	4	14·33	8 Sept., 18 Sept., 2 Oct., 16 Oct.
Lime-sulphur 0·083 per cent., 0·083 and colloidal sulphur 2–100, 0·083 plus colloidal sulphur 2–100	4	11·87	8 Sept., 18 Sept., 2 Oct., 16 Oct.

Infection on treated plots was mostly summer infection.

Powdery Mildew.—The following results of official experiments carried out in Hawke's Bay and at Alexandra demonstrate the efficacy of the treatment recommended.

The sprays were applied to Jonathan trees on the basis of the foregoing programme with the following results :—

District.	Check Plot.	Treated Plot.
Hawke's Bay ..	No control of powdery mildew. Leaves curled and browned at edges	Very good control. Clean, healthy foliage, which was of a dark-green tone. Foliage remained free of mildew throughout season. Preblossom sprays prevented initial infection.
Alexandra ..	No control. Early part of season moderate infection which as season advanced became heavy on foliage, shoots, and buds	Very good control. Infection was very light on foliage and tips of shoots and spurs. Most infection will be removed at pruning-time.

Similar results were obtained in the trials carried out in the Canterbury District.

PEACH LEAF-CURL.

For peach leaf-curl the treatment recommended is—

Period of Application.	Treatment.
Autumn or early bud-movement of blossom-buds	Bordeaux 5–4–50.
Early pink	Bordeaux 3–4–50.

Peach leaf-curl may be completely controlled by one spray applied in the autumn or in the spring prior to green-tip of the most advanced leaf-buds. It is all-important to ensure that the spray is applied prior to the leaf-buds reaching the green-tip stage, which is too late to obtain satisfactory control. Care should be taken to see that the laterals, particularly the tips, are sprayed. The results of all our official experiments support the above.

BROWN ROT AND LEAF RUST.

For brown rot and leaf rust the treatment recommended is—

Period of Application	Brown Rot.	Leaf Rust.
Early pink	Bordeaux 3–4–50 or lime-sulphur 1–75	..
Pink	Lime-sulphur 1–150 ..	..
Petal-fall	Lime-sulphur 1–180 plus colloidal sulphur 2–100	Lime-sulphur 1–800 plus colloidal sulphur 2–100.
1 month later	Ditto	Ditto.
7 weeks later	,, ...	,,
5 weeks prior to anticipated first picking	,, ...	,,
2 to 3 weeks later ..	,, ...	,,

NOTES.—Lime-sulphur refers to a specific containing 15 per cent. of polysulphide content, calculated on the basis of weight.

It is not advisable to apply sulphur sprays to apricot-trees while fruit is upon them.

Brown rot is a rather difficult disease to control, particularly under moist and humid climatic conditions. In such localities the only satisfactory way to overcome the trouble appears to be by way of securing, if possible, more resistant varieties. Under normal conditions, however, much can be done to reduce infection in addition to spraying.

The following are rules of orchard hygiene—elimination of sources of infection : (*a*) Prune out and destroy all diseased twigs and branches at winter pruning and in the spring after blossoming, as these are a means of carrying the disease over to future years. (*b*) Pull off and destroy all " mummies," as they also carry over the infection. (*c*) Pick off all infected fruits during growing and ripening periods, as the fungus works from these into the wood of the trees. (*d*) Gather up and burn all prunings and mummies. (*e*) Cultivate at the " pink " period. Soil missed by the implements should be disturbed by hand implements. Every endeavour should be made to break up all compacted surface soil, particularly about the trees. (*f*) Insects (flies, earwigs, &c.) play a prominent part in the distribution of brown rot during the fruit-ripening period Clean up all rubbish and litter and deprive them of a breeding-ground and a shelter. (*g*) Prune trees to admit air and sunlight. (*h*) Open up tall, close shelter-belts sufficiently to admit sunlight and a free circulation of air throughout the orchard.

Fruit Thinning.—Thin the fruit so that no two fruits touch each other.

Picking and Packing—(*a*) Pick fruit carefully, and reject all fruits showing skin punctures and bruises (*b*) Great care should be taken to prevent infected fruits being sent into the packing-shed. (*c*) In the orchard infected fruits should not be dropped on the ground, but put in a tin for the purpose containing sufficient liquid (lime-sulphur 1–180) to cover the fruits to prevent the spores escaping Bury the contents of the tin to a depth of at least 2 ft. (*d*) Pick into boxes or tins in preference to using the picking-bag, which is not recommended for stone-fruit harvesting. (*e*) Second-hand cases and trays should be sterilized. (*f*) Picking-tins should be sterilized daily. Immerse for a minute in boiling water, lime-sulphur solution (1 50), formalin solution (1–40), or bluestone solution (1–100). Do not treat tins with bluestone solution, as they will corrode. Cases must be dried before fruit is packed in them. (*g*) Clean and sterilize grading-tables thoroughly after each day's work. This should not be neglected. (*h*) To minimize chances of infecting sound fruits while they are being picked and packed, those handling diseased fruits should be careful to clean their hands before (*j*) After packing, stack fruit in such a manner so that an air current handling sound fruits again. (*i*) Allow fruit to stand in a cool place. may pass between the cases so as to allow of the heat given oft by the fruit to quickly escape.

TREATMENT FOR SILVER-LEAF (STEREUM PURPUREUM).

The fungus penetrates trees through wounds formed during pruning or ploughing, or through broken branches. It lives over from season to season on infected fruit-trees, silver birch, poplar, willow, and broom, and produces its fructifications on dead branches of these hosts. From these, spores are spread which are capable of infecting wounds and reproducing the disease in healthy trees in the vicinity. Consequently to combat the disease it is necessary to—

(1) Remove and burn infected branches, preferably during the early summer, cutting well below the visible point of infection. Cut stubs and broken branches as close to the main branches as possible, and dress and smooth with a sharp knife so that the wounds may callus over rapidly.

(2) Cover all wounded surfaces as soon as made with a protective cover, such as bitumen paint, coal-tar, or white-lead paint.

CITRUS TROUBLES.

In the control of diseases and pests of citrus-trees the recommendation is—

Period of Treatment.	Verrucosis, Grey-scab.	Scales.		Thrips.
		Brown.	Red and White Wax.	
Opening of earliest blossoms (October)	Bordeaux (3-4-50)		..	
Blossom-fall of main crop (November)	Bordeaux (3-4-50)	..		Nicotine sulphate 1-800 Combine with bordeaux spray
During December January		Summer oil (1-60)	Summer oil (1-33)*	.
During late February	.	..	Ditto	Summer oil (1-60) plus nicotine sulphate (1-800)
Towards end March		..	„	Repeat when necessary.
Blossom-fall of autumn crop (March-April)	Bordeaux (3-4-50)	..	..	Ditto.
During mid-April .	.	..	Summer oil (1-33) if necessary	„

* This application recommended for certain years when young red scales are hatching freely at this period

Leaf-roller Caterpillar.—Apply lead arsenate 1½-100 when infection is anticipated, and repeat at three-weekly intervals.

Thrips.—If summer oils have not been applied to the trees, lime sulphur (1-40) may be used for the control of thrips at the times specified in the above schedule.

Bark-blotch.—Remove infected tissues around the cankers. Treat the wounds with either—(1) Bordeaux paste or (2) swab wounds with solution acidulated mercuric chloride, and, when dry, paint wounds with a protective covering such as bitumen paint, coal-tar, or white-lead paint.

Brown Rot.—For the control of this disease growers are recommended to remove all branches within 3 ft. of the ground, and to stir the soil during the summer months beneath the trees sufficiently frequently to maintain a layer of dry soil about 3 in. in depth. In the autumn allow volunteer growth of herbage to grow or sow cover crop.

Sprays are most effective against scales while this pest is in the "crawler" stage. The emergence may commence as early as December.

It is inadvisable to apply oils to citrus trees later than the end of April and to apply " winter " oils to the trees.

RUSSET ON APPLES.

Russet is a matter of serious concern to apple-growers on account of the depreciation it causes to the appearance of the fruits. As tree impoverishment greatly influences russeting, it may be considerably reduced by giving the orchard good care and maintaining the trees in a vigorous, healthy condition. Much investigational work has already been done, and workers are still endeavouring to discover a method of reducing the amount of this type of blemish. It is not an easy problem to solve, on account of the number of factors involved Briefly, the principal factors which, either singly or a combination of two or more, influence russeting are --(1) Unthrifty condition of trees due to various causes. Fruit produced on vigorous trees is less susceptible to russet: (2) Unsuitable climatic conditions, including wind, frost, &c · (3) Unsuitable soil conditions: (4) Disease (powdery mildew): (5) Spraying: (*a*) Application of sprays which are too caustic to newly-formed fruits; (*b*) Application of sprays in excess volume; (*c*) Retention of sprays in liquid condition on the surface of fruits for indefinite periods. (Late evening applications under high relative humidity are very liable to cause russeting); (*d*) Sprays containing gritty materials

The sprays in common use which cause russet on apples are—(1) Bordeaux mixture when applied to certain varieties such as Sturmer Pippin later than the " green-tip " period. On other varieties this spray may be applied as late as the " tight-cluster " period with safety: (2) Strong lime-sulphur sprays: (3) Lime-sulphur - lead-arsenate combination is a source of much injury if incorrectly prepared.

To reduce spray injury—(1) Prepare the mixture as follows: Lime sulphur and lead arsenate.—Fill the tank with water, and to this add the required volume of lime-sulphur. To the required quantity of lead arsenate add three times its weight of hydrated lime, mix with water to form a thin paste, and pour it into the spray-tank while the agitator is running. Apply as rapidly as possible after mixing It is advisable to confine the quantity of the respective mixings to such quantity as may be discharged within one hour: (2) Prepare sprays carefully: (3) Cover trees thoroughly with a film of spray, but do not overspray them: (4) Care and judgment should be used in applying this combination spray. Avoid as far as practicable applying lime-sulphur-lead-arsenate combination spray when the surface of the fruit is liable to remain wet with spray for several hours. Also care should be used in applying this spray during periods when high temperature and high relative humidity prevail: (5) In localities exposed to winds off the sea, as long a period as possible following such winds should be allowed to elapse before a sulphur spray is applied, on account of the saline deposit which these winds leave on fruit and foliage.

In conclusion the following points are important: ·

(1) While the schedules given are designed to cover seasons of maximum infection of diseases and pests, it is important that growers should bear in mind that under different climatic conditions the times of sprayings and the number of sprayings and dilutions may require to be varied to some extent to meet local seasonal conditions. For advice on such matters growers are advised to interview the Orchard Instructor for the district, who will be pleased to give full information.

(2) While orchard sanitation (elimination of sources of infection) will in itself not completely eradicate diseases and pests, it should be practised in every orchard. The following measures are recommended: (*a*) Clean up and destroy all rubbish and litter in and about the orchard, as they provide a breeding-ground and shelter for diseases and pests. (*b*) Prune out from time to time as it appears, and destroy dead and dying wood. (*c*) Gather and destroy diseased fruits and mummies, windfalls and dropped fruit, and cull fruit without undue delay. (*d*) Cultivate the soil at appropriate periods calculated to prevent the development and dissemination of spores from organisms carried over in the soil. (*e*) Prune trees sufficiently so as to admit sunlight. (*f*) Thin the fruits judicially. (*g*) Reduce in height and open up tall and close shelter-belts in order to admit sunlight and a free circulation of air throughout the orchard. (*h*) Bandage trees to trap codling moth larvæ, and examine crevices in bark for larvæ. Remove any rough bark which may be present. (*i*) During picking and packing take every care and precaution to avoid infection of sound fruits with fungous diseases.

(3) Thoroughness of application is very advisable. Special attention should be given to the inside as well as the outside of the tree, and to the tops and bottoms as well as the middle portions of the tree to ensure that all fruits receive a complete coating of spray. Careful spraying is necessary to receive maximum protection and to avoid over-spraying and spending more time than is necessary. To insufficiently spray trees is both a waste of materials and time. This fault is much more common than it should be, and growers who fail in this respect are ready to blame the materials, the dilution, the schedule, the season, and the advice given for their failure to control diseases and pests. A study of the reports of Instructors conducting spraying experiments indicates that it takes approximately 3 gallons of spray to cover adequately an average-sized tree in foliage, while larger trees require increased quantities according to the size and density of foliage. The pump should be capable of delivering 3 gallons per minute at a pump pressure of upward of 250 lb. to the square inch. A spray-rod fitted with an angle nozzle or two in combination should be used in preference to a spray-gun, particularly for the "calyx" spray and for spraying the bottoms of the trees. Spraying followed by rain within twenty-four hours should be repeated.

(4) Timeliness of application contributes greatly to success. To the neglect of this can be traced the failure of many orchardists to control diseases. Orchardists whose results from spraying are not satisfactory are invited to discuss their schedule with the local Instructor, with a view to the modification of the times at which it is proposed to apply sprays, dilutions, &c., to meet the local requirements.

(5) Use of tried specifics is advisable. There is a distinct trend on the part of overseas manufacturers to bring forward numerous new brands of orchard sprays or spraying-materials. These should be regarded with caution until their efficacy has been demonstrated.

(6) Want of care does more harm than want of knowledge. In other words, better crops are not obtained because sufficient care is not given to cultivation, manuring, orchard hygiene, application of sprays, thinning, &c. The amount of harm this lack of care does will never be realized until the necessary attention is given to carrying out orchard practices properly.

SUBTERRANEAN CLOVER IN THE NORTH ISLAND.

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AT the 1936 conference of the New Zealand Grassland Association a group of four papers on subterranean clover was read by field officers of the Department of Agriculture, giving the experience with this clover as a pasture species in North Auckland and South Auckland (excluding the King-country, the pumice lands of the central plateau, and Bay of Plenty), Manawatu and west coast, and Hawke's Bay. During the subsequent discussion of the papers the position in Taranaki, Wairarapa, Poverty Bay, Bay of Plenty, and other parts of the Auckland Province, including the pumice country round Rotorua and Taupo, was indicated. It is the intention in this article to summarize the present position and possibilities of subterranean clover in the North Island as disclosed by the papers and the discussion.

GENERAL CHARACTERISTICS.

Subterranean clover is a strongly growing and very palatable annual clover, which buries its seed in the surface soil, ensuring its permanence when once established in a sward. The seeds germinate with the autumn rains, and the plant grows and develops through the autumn and winter and comes away earlier than most pasture species in the spring, giving its maximum growth in the North Island from August to November. Flowering takes place during the period of maximum growth, and the plant dies off with the approach of hot, dry, summer weather. The seed which is buried as the plant develops lies dormant in the soil until the autumn rains come. An essential condition to free re-establishment is the opening-up of the sward to some extent through the summer, while essential conditions to good early spring production are early autumn establishment, freedom from water-logging in the winter, moisture and warmth in the spring, and, above all, adequate phosphatic manuring. As with all pasture-plants, the more fertile the soil the higher the production, but subterranean clover has a surprisingly wide range in regard to soils, and, with adequate phosphate supplies, will easily outyield all other annual clovers on most second- and third-class land.

RECENT WIDESPREAD INTEREST IN SUBTERRANEAN CLOVER.

Though subterranean clover has been known in certain districts of the North Island for the past fifty years, particularly as Mangare clover on the volcanic soils near Auckland and on similar soils in the vicinity of Whangarei, it is only in recent years, following its wider use and extensive propaganda in Australia, that a similar realization of its possibilities in this country has developed. While in the past subterranean clover has been mainly confined to dairy pastures and high-rainfall areas, it is in connection with sheep-farming and in districts of lower rainfall and dry summers that present interest is chiefly centred.

EXPERIENCE IN VARIOUS DISTRICTS.

NORTH AUCKLAND(1).

Subterranean clover has long been appreciated as a valuable clover in dairy pastures on free-draining volcanic soils. Its tendency to smother other species under light stocking and the prevalence of bloat in cattle in favourable seasons have been regarded as bad faults, but under good management and utilization it has shown clearly its capacity for high spring production. The fact that rye-grass, white clover, and paspalum can combine well with subterranean clover under good management is now generally recognized, and this clover is accepted as a useful additional species. It is, however, on the older, consolidated, sand-dune country of the west coast too dry in summer to hold white clover, and where its superiority over *Lotus hispidus* and suckling clover, the main legumes of the pasture, is very marked, that its use should be developed. On sandy gum land also there is considerable scope for the extension of subterranean clover. The main requirement in both cases is adequate phosphatic manuring which the introduction of subterranean clover would make profitable on swards at present not capable of giving satisfactory returns for top-dressing.

As in many other districts, it is in connection with fat-lamb production that the use of subterranean clover is likely to prove most profitable in North Auckland. Much of the rolling sandstone and greywacke hill country at present carrying dry stock and not worth top-dressing could, with the introduction of subterranean clover and phosphatic manuring, be converted into fat-lamb pastures.

SOUTH AUCKLAND(2)

The area covered in this paper extends from Auckland south to the Waikato. Subterranean clover has been recognized for many years in the Manakau and Franklin Counties as a valuable clover additional to white clover, particularly on account of its ability to re-establish quickly after occasional dry summers, when white clover may be practically killed out. Because of the usual adequate summer rainfall of South Auckland dairying lands, white-clover establishment is, however, generally the aim on most dairy-farms. Subterranean clover is appreciated on the volcanic lands and lighter pumice soils for its early and heavy feed-production and the excellent silage it makes. As in North Auckland, there is likely to be a considerable extension of the use of subterranean clover for fat-lamb production, particularly on the lighter volcanic, sandstone, and pumice soils, when its value in this direction is more fully appreciated.

MANAWATU AND WEST COAST(3).

In this area, extending from Paraparaumu to Wanganui and from the west coast to the mountain ranges, the value and possibilities of subterranean clover on different types of country have been well demonstrated by changes effected in the production of farms since its introduction. The reason for the increase in the quantity of subterranean-clover seed sown in the Manawatu district from a few pounds five years ago to 12 tons in 1936 is quite apparent when the scope for the use of subterranean clover is realized.

On the coastal belt of consolidated sands, with a rainfall of 35 in., the introduction of subterranean clover to certain farms has been the means of converting poor dry-stock country to dairying and fattening land at a much lower cost and much more rapidly and satisfactorily than was the case where the usual methods of attempting the establishment of rye-grass and white clover have been used With the ordinary pasture species sown on the best of the consolidated sandy flats, the tendency to reversion to sweet vernal and *Poa pratensis* is very marked. The establishment of subterranean clover, with less than the usual phosphatic top-dressing, has given a rapid increase in production and a steady improvement in the sward Subterranean clover, sown with the grass-mixture on the richer flats after a root crop or rape, drilled into the existing swards on the poorer flats, and broadcast on the sandy ridges, is paving the way to profitable top-dressing and the successful establishment of such species as perennial rye-grass and white clover. Changes from one dry sheep to three and four ewes per acre or a cow to 2 acres are being made through subterranean clover It is very apparent that the limit of carrying-capacity on this country has not been reached, since lucerne and paspalum, both of which thrive well, are being gradually exploited to provide additional summer feed to carry on when the subterranean clover goes off. There is also in the district a considerable area of light friable loam characterized by a marked tendency to reversion to brown-top and danthonia. Subterranean clover on this country is also giving remarkable results. Dry-sheep country sown with 2 lb to 4 lb of subterranean clover and top-dressed with 1½ cwt. to 2 cwt. of superphosphate is being changed rapidly so as to be able to carry three to four and more ewes per acre, with the lambs going off fat earlier than is usual on the heavier land. From Palmerston North through Feilding, north to Marton and beyond, there is a wide stretch of heavier, flat, undulating country with bad natural drainage, and a tendency to rushes and brown-top. Individual farmers in this area have demonstrated the value of subterranean clover, either broadcast on the existing sward or sown with a grass-seed mixture, in rapidly increasing the carrying-capacity of this land both drained and undrained.

The light sandy coastal belt, the friable clay loams, including much of the lower foot-hill country along the ranges, and the heavier rolling clay lands of this portion of the Wellington Province represent some 350,000 acres, and it is safe to say that the exploitation of subterranean clover by farmers on this area would mean at least doubling the carrying-capacity

HAWKE'S BAY(4).

It is undoubtedly in Hawke's Bay, with its occasional very dry summers and vast areas of light freely draining soils extending from Woodville through Norsewood, Takapau, Maraekakaho, to Tutira, Putorino, and Mohaka up to the Wairoa flats and beyond, that subterranean clover has especially demonstrated its wonderful potentialities as a valuable pasture species. Right through this belt of country, estimated at upwards of 500,000 acres, the introduction of subterranean clover, whether it be by inclusion in the seed-mixture after ploughing, by surface-sowing with top-dressing after severe harrowing of the existing sward, or by surface-sowing with fertilizer on open danthonia or brown-top turf, has resulted in a very definite increase in carrying-capacity. The response of the subterranean clover to superphosphate has been remarkable, and the ability of this clover to produce feed for lamb-fattening just when required is appreciated. The doubt as to whether top-dressing pays on much of the rolling to steep hill country has been removed by the introduction of subterranean clover, and in Hawke's Bay, as in Manawatu, Wairarapa, and Poverty Bay districts, some outstanding increases in carrying-capacity have been recorded. Other country suitable to the exploitation of subterranean clover in Hawke's Bay are the Takapau Plains, the lighter soils of the Hawke's Bay flats, much of the limestone country which has shown reversion, and the extensive area of coastal and southern hill country. It is indeed difficult to visualize the result of the full exploitation of subterranean clover in the province. The quantity of seed being sown is rapidly increasing. Last season some 30 tons was used, sufficient at 4 lb. per acre to sow over 15,000 acres.

The fact that when fully utilized it gives its greatest returns, that set-stocking with ewes and lambs is a relatively simple matter when once the carrying-capacity is gauged, and, further, that subterranean clover well utilized is helping to bring back rye-grass and white clover, are points which are likely to bring about a rapid extension of the area sown to this clover. On some of the lightest pumice country in the district increases from one dry sheep to the acre to five and six ewes with all lambs away fat are recorded.

WAIRARAPA AND POVERTY BAY.

In both these districts large quantities of subterranean-clover seed are being sown, the quantity increasing rapidly each year. In the Wairarapa, subterranean clover is being used with excellent results on the lighter shingly soils of the plains, and is having a very marked effect on the carrying-capacity both for dairying and sheep-farming. Recorded experience has shown that much of the rolling hill country, especially the coastal belt, could be rapidly and profitably improved by subterranean clover, which allows so definitely for the profitable use of top-dressing on swards that probably do not pay for manure. In the same way in Poverty Bay, subterranean clover is destined to play an important part in the regeneration of much of the hill country. Many farmers are now exploiting subterranean clover, and it is evident that this clover is likely to overcome the difficulty of the relatively high cost of top-dressing in this district.

INFORMATION FROM DISCUSSION OF PAPERS.

It appears from the discussion at the conference of the New Zealand Grassland Association that in the North Island on all the lighter soil types subject to drying out in the summer, subterranean clover can be used to advantage. Its ability to give rapid and effective response to phosphatic manuring and the subsequent improvement in the conditions for rye-grass and white clover through heavier stocking are the main contributing factors to its success. The Bay of Plenty, with its extensive areas of light soils and dry summers, should find in subterranean clover a valuable pasture species likely to outyield the suckling clover and *Lotus hispidus* prevalent on much of this country.

In the King-country, the Waikato, Rotorua, and Taranaki the satisfactory reseeding of subterranean clover may be hindered from time to time by the closeness of the sward in January and February in seasons of good summer rainfall. In the Waikato and the coastal areas of Taranaki, however, subterranean clover is proving a valuable additional clover, and on the poorer soils in these districts, if fully exploited, is capable of improving the fertility up to rye-grass and white-clover requirements.

A discussion of the altitude range of subterranean clover showed that it was being successfully grown at an altitude up to 2,000 ft. in the Raetihi and Poverty Bay districts, and it is evident that the possibilities in the central tableland to the south of Taupo are well worth investigation. While considerable detail was available at the conference as to methods of establishment and utilization under widely varying conditions, such information is best obtained from the officers of the Department of Agriculture in the districts covered by this review.

POSITION OF SUBTERRANEAN CLOVER IN NORTH ISLAND REVIEWED.

Reviewing the position in regard to subterranean clover in the North Island in the light of the papers read at the conference and the discussion on them the main points can be summarized as follows:—

(1) In the Wairarapa, Manawatu, Wanganui, Hawke's Bay, and Poverty Bay districts an area estimated at upwards of 1,500,000 acres of grassland could be converted rapidly and economically from dry-stock to fattening land by the use of subterranean clover and phosphatic manuring. In the Auckland, Taranaki, and Bay of Plenty districts, while the value of subterranean clover in fat-lamb production has not been tried out to the same extent as in the southern half of the Island, and the soil and rainfall conditions generally are not so well suited to subterranean clover, there are indications that this clover could well replace inferior annuals such as suckling and *Lotus hispidus* on considerable areas of second- and third-class country, particularly where the returns from top-dressing are doubtful

(2) The seasonal production from subterranean clover coincides exceptionally well with the seasonal requirements of the ewe and lamb, and set-stocking in the spring to the limit of what the paddocks will carry is the best method of utilization. The clover re-establishes well, when once thick enough to form a sward, under heavy stocking.

(3) Phosphatic manuring is essential to subterranean clover on poor soils. Lime is not nearly so important as it is with white clover. and can be used as a forerunner to good rye-grass and white clover Subterranean clover, therefore, responds well to superphosphate, and lime is required only in exceptional circumstances

(4) Subterranean clover fully utilized is a valuable soil-improver, establishment, with which it combines well when adequately stocked.

REFERENCES.

(1) Paper read by E. B. Glanville at 1936 Grassland Conference.
(2) Paper read by J. Bell at 1936 Grassland Conference.
(3) Paper read by A. J. Galpin at 1936 Grassland Conference.
(4) Paper read by J. W. Palmer at 1936 Grassland Conference.

GERMINATION OF "NEW SEASON'S" ALGERIAN OATS.

E. O. C. HYDE, Seed-testing Station, Palmerston North.

GENERALLY farmers are aware that the sowing of "new season's" oats in the autumn is attended by the risk of poor germination. This danger is often avoided by sowing at a heavy rate, or by using "old season's" seed. Nevertheless, the difficulty of judging the suitability of seed for autumn sowing not infrequently results in considerable loss. The trouble arises from the fact that the oat grain generally requires several months for its complete after-ripening.

It is characteristic of the seeds of many plants that they are incapable of germinating when newly ripened, or can be brought to germinate promptly only by the application of some special stimulus. During storage changes take place which render these "dormant" seeds capable of prompt germination. In this connection we speak of the process of "after-ripening," although the nature of the changes involved is still largely a matter of conjecture.

The oat grain for some weeks or months after harvesting is in a "dormant" state, and only gradually, with the progress of after-ripening, acquires its full germinating-capacity. Dormant oats germinate, however, if they are first placed for about six days under moist conditions at a temperature within a few degrees of freezing-point. Thereafter they will continue to grow in a normal manner at higher temperatures. Under warm conditions (20° to 30° C.) dormant oats germinate completely only after the lapse of months. Furthermore, after a period of several days under these warm, moist conditions the seed loses its capacity to respond to the stimulus of low temperatures. Fully after-ripened oats, on the other hand, germinate within a wide range of temperature, from near freezing-point to as high as 30° C., the optimum temperature being about 20° C.

As regards germination, the behaviour of newly harvested oats is the same in the field as in the laboratory at temperatures comparable with the soil temperatures. There are ample grounds for the belief that soil temperature is generally the limiting factor in determining the rate of germination of dormant or partially dormant oats in the field.

The temperature of the soil, near the surface, varies widely at all seasons, but in the fine weather which prevails during the autumn months it frequently rises (in tilled ground) to over 30° C., while the minimum night temperature may be as high as 20° C. A comparison of the germination of a number of samples of partially dormant oats in the field and in the laboratory showed that during the autumn months there is close agreement between the percentage germination in the field and the percentage in the laboratory with temperature fluctuating daily between 20° C. and 30° C. The Seed-testing Station has now adopted the practice of making two tests of each sample of oats received during the summer and autumn. In one test the grain is pre-chilled, whereby all dormant seeds are induced to germinate. From this test we learn the proportion of living seeds, and the probable future germinating-capacity in the field when after-ripening is completed or when the prevailing soil temperature is low. The second test is made with the temperature at 30° C during the day and at 20° C. at night. This test gives the approximate rate of germination which can be expected in the field if the seed is sown immediately.

In this way the difficulties attending the selection of seed can be overcome. There remain, however, problems relating to the supply of seed.

The time occupied by after-ripening varies from crop to crop, and the average duration of the process varies from season to season Although it was known that after ripening proceeds slowly after a cool and rainy summer, it has been impossible to foretell when any crop of oats would become suitable for use as seed.

Several investigators have observed that oats, like other cereals, can be "artificially after-ripened" by prolonged kiln-drying. Some preliminary studies have been made at the Seed-testing Station with a view to exploring the possibilities of hastening after-ripening in the grain-store

Experiments designed to show the separate effects of temperature and moisture content were productive of the following information: The reduction of the moisture content has no immediate effect on the germinating-capacity. Both moisture content and temperature influence the rate of after-ripening, but temperature is the more potent factor After-ripening is greatly delayed by storage at low temperatures, and is hastened by storage at relatively high temperatures When stored at 30° C. samples of oats having a wide range of moisture content were all completely after-ripened within twenty-four days. By maintaining the storage temperature at about 30° C. it appears to be possible, at little cost, to have oats ready for sowing within four weeks after threshing from the stook. Prolonged storage at this temperature is injurious to the vitality of the grain, unless the moisture content is low. However, oats with a moisture content as high as 17·6 per cent. showed a decline in germinating-capacity only after storage for two months at 30° C.

The necessity for forcing the after-ripening of oats may seldom arise. It may more frequently be of assistance to grain-merchants to be able to foretell when a given lot of oats will become available for use as seed. Probably when more experience has been gained it will be possible to accomplish this. By determining the germinating-capacity and the moisture content of a sample of the grain, and also the prevailing temperature of the store, it probably will be possible to make some estimation of the time required for the completion of after-ripening.

The Fields Superintendent, Christchurch, reports: A North Canterbury farmer sowed an area of lucerne in February, 1934; one portion was manured with superphosphate, a second portion with Nauru phosphate, and a third with reverted superphosphate, each being applied at the rate of 1¼ cwt an acre on limed land. The growth on the portion dressed with superphosphate was well ahead of the others in April, and the effect of the reverted superphosphate was no better than that of Nauru phosphate.

NOTE ON THE CARE OF WEANER AND YEARLING HEIFERS.

D MARSHALL, Veterinarian, Department of Agriculture, Hamilton.

CONSIDERABLE mortality occurred in this class of stock during the winter of 1936, and much of the loss was directly or indirectly due to internal parasites, chiefly stomach-worm, though lung-worm was troublesome in some instances. In South Auckland the summer was wet, and this favoured the survival of a large percentage of the parasites during the period passed in the larval stages outside the host. Further, the sloppy pasture-growth during a wet season itself predisposes to a loose state of the bowels, and seems to be less suitable for young animals than the feed available in a drier season.

There is an intricate relationship between the type of food and the presence of parasites in producing the characteristic unthriftiness, debility, anæmia, and scouring usually (and in most cases rightly) put down to worms. It is not always easy to know just how much of the trouble is due to type of feed in itself and how much to the presence of parasites.

In some instances a single treatment with a reliable worm-drench checks mortality and is followed by improvement in the remainder. At other times repeated drenching seems of little benefit unless aided by better feeding. The Rowett Institute has shown that with young sheep some supplementary feeding greatly reduces the number of parasites that becomes established in the sheep. In Australia Clunies Ross has shown much the same thing, and states that, in combating some of the small worms resistant to drenching, most benefit comes from improving the feed. With young cattle, observant feeders in this country have remarked on the importance of improving the feeding of worm-infested heifers by crushed oats, bran, and linseed-meal, and even by putting the young animals back on a ration of milk.

Routine drenching of young sheep is accepted as a necessity on many sheep-farms. The same conditions apply in young cattle. Parasitic disease is one of the penalties to be paid for permanent pastures and heavy stocking, and must be guarded against. Drenching of young stock once mortality has commenced is sometimes disappointing in its results. Among the several reasons for this are—(*a*) Treatment is not begun until all animals are already in an anæmic state and have lost condition ; (*b*) insufficient attention is paid to supplementing the action of the drench by some improvement in feeding (complete elimination of worms, even if it were possible, would still leave the animal in an anæmic, weakly state calling for nursing and tonics) ; (*c*) animals are returned to the same pastures and reinfection is constantly taking place.

The symptoms of parasitic gastritis are unthriftiness, harsh coat, and a " skinny " appearance, weakness, anæmia indicated by pallor of lining of eyelids, &c., and nearly always some degree of scouring. Somewhat similar symptoms are seen in " bush-sick " cattle, but scouring is not a feature.

Indications at present point to the coming summer being favourable to the development of parasitic disease, and in view of the increase in value of dairy yearlings additional care is justified to bring them through their first and most critical winter. If there is a choice between dry, sunny faces and damp flats the former should be chosen as a grazing-area for yearlings. Heavily top-dressed pastures are not ideal, but a newly-sown paddock, being clean, should be suitable, if the feed is not too laxative. Ample range is always desirable, but on smaller dairy-farms may not be available.

Where suitable grazing-areas are not available, and particularly where parasitic gastritis has been in evidence in the past, drenching should be commenced not later than the 1st of March, and repeated at least once a month. In this way parasites are kept in check, and it is easier to maintain condition on such animals than to try to replace it in ones enfeebled and anæmic through parasites.

A suitable worm-remedy is the bluestone and nicotine used for sheep. If this is mixed at the rate of 2 oz. bluestone and 2 oz. of 40-per-cent nicotine sulphate to 1 gallon of water, six-to-eight-months calves may be given 4 oz , increasing gradually to 6 oz. at a year old. It may be found that a few yearlings will be made staggery and will go down, but these will recover in a few minutes If this happens the amount of drench may be slightly reduced No preliminary fasting is necessary, but it is desirable to yard the animals for two hours beforehand and to keep them from water for one hour after drenching.

In addition to routine drenching, feeding must be adequate. Good hay should be available from the end of April. A small amount of concentrated food such as crushed oats, and bran, with a little linseed-meal, or meat-meal will be helpful in July, usually the hardest month.

Shelter is highly important · an open-fronted shed, or access to a good haystack, will at least give warmer sleeping-quarters if good hedges are not available. In ridgy country the lie of the ground may give a certain amount of shelter from prevailing winds.

No mention is here made of treatment of lung-worms, but the same general control measures are beneficial in combating these Drenching, while of almost no value against lung-worm, should not be neglected, as very often, though lung-worms are present and the frequent cough due to them is in evidence, the stomach-worms are the real offenders.

GOVERNMENT OFFICIAL HERD-TESTING OF PUREBRED DAIRY COWS.

SUMMARY OF THE 1935-36 SEASON'S WORK.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE Government Official Herd-testing has now been in operation for nine years, the present summary covering the year ending 30th September, 1936. Since the inception of the system 16,701 statements of seasonal production have been issued, representing an average of 1,855 cows per year. During the past season 1,910 cows were tested, a decrease of 148 cows from the 1934-35 total of 2,058. The cows tested during the season under review were in the herds of 183 breeders, as compared with 195 herds for the previous season. The maximum number of Certificate-of-Record breeders with cows on test during the same period was 237, so that over 75 per cent. took advantage of the Government official herd-testing system.

Average butterfat production per cow showed an increase of 16·28 lb., the 1935–36 average being 326·32 lb. fat, as compared with 310·04 lb. for the previous season. The statistics appearing in this review are based on all cows on test for six months (180 days) or more. The Government Official Herd-test is a ten-months test. Cows other than registered purebreds are omitted from the tables, although a small number are tested each year by special arrangement. The number of cows tested under this heading during the period under review was thirty-two, as compared with thirty-one for the previous season. Registered purebred cows totalling 125 were on test for less than 180 days, and are therefore not included in the summary tables.

The following figures provide a comparison of average butterfat production for the various systems of testing in the Dominion: New Zealand's average herd-test cow for the 1935–36 season, including all cows in milk 100 days or more, yielded 257·64 lb. butterfat in 258 days. The Government Official Herd-test average on the same basis was 322·19 lb. in 283 days, while the Certificate-of-Record 305-day test average was 417·76 lb., and the Certificate-of-Record 365-day test 516·30 lb.

Table 1—Official Herd-testing in Two Past Seasons on Basis of all Cows on Test for 180 Days or More

Breed	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days.	Milk.	Butterfat.
	Season 1934–35.			Lb.	Lb.
Jersey	151	1,368	287	5,955·7	320·85
Friesian	20	285	284	8,271·6	295·19
Milking Shorthorn ..	7	182	270	6,332·9	264·69
Ayrshire	2	31	292	6,708·2	266·06
Red Poll	1	4	234	3,324·3	134·44
Guernsey	1	6	300	5,079·6	271·26
Shorthorn	Not represented.				
Totals and averages	178*	1,870	285	6,348·2	310·04
	Season 1935–36.				
Jersey	160	1,350	272	5,765·7	315·72
Friesian	16	392	275	8,402·6	299·19
Milking Shorthorn ..	6	108	277	7,477·6	306·95
Ayrshire	1	6	305	5,455·0	241·91
Red Poll	1	19	260	5,288·7	214·77
Guernsey	Not represented.				
Shorthorn	2	3	242	6,800·2	250·92
Totals and averages	183*	1,878	273	6,410·4	310·41

*** Totals do not agree since some breeders tested more than one breed.**

Table 2.—Average Production in Classes and Breeds for all O H.T Cows.

Class.		Season 1934–35. Number of Cows.	Season 1934–35. Average Days.	Season 1934–35. Average Milk.	Season 1934–35. Average Butterfat	Season 1935–36. Number of Cows.	Season 1935–36. Average Days.	Season 1935–36. Average Milk.	Season 1935–36. Average Butterfat.
				Lb.	Lb.			Lb.	Lb.
Jersey	Two-year-old and under ..	582	286	5,252·4	282·42	503	288	5,460·7	300·10
	Three-year-old	218	287	6,139·9	341·51	265	290	6,166·1	339·36
	Four-year-old	199	286	6,465·8	346·45	173	287	6,474·5	360·53
	Mature	369	289	6,681·3	355·45	318	282	6,702·5	363·01
Friesian	Two-year-old and under ..	86	284	7,274·5	256·84	70	290	7,369·1	266·03
	Three-year-old	46	278	7,865·8	279·55	72	288	8,258·7	295·10
	Four-year-old	47	275	7,841·1	283·67	59	282	9,031·8	322·05
	Mature	106	289	9,447·5	338·24	162	292	9,686·7	343·22
Milking Shorthorn	Two-year-old and under ..	45	275	5,159·4	211·09	14	286	5,906·3	246·77
	Three-year-old	33	274	5,672·6	252·92	26	282	6,593·2	273·19
	Four-year-old	33	269	5,874·3	270·00	22	283	7,341·2	307·10
	Mature	71	281	7,597·2	301·63	43	282	8,922·2	360·02
Ayrshire	Two-year-old and under ..	6	291	5,099·7	209·79	5	305	5,442·3	241·03
	Three-year-old	2	287	5,844·2	245·40	1	305	5,518·1	246·31
	Four-year-old	4	303	7,338·4	292·02	..	..	..	..
	Mature	19	290	5,174·8	280·54	..	..	..	..
Red Poll	Two-year-old and under ..	4	234	3,324·3	134·44	3	251	4,883·6	215·17
	Three-year-old	..	..	..	..	4	287	4,529·9	179·88
	Four-year-old	..	..	..	..	4	274	6,285·2	238·72
	Mature	..	..	..	..	6	277	6,184·4	256·95
Guernsey	Two-year-old and under ..	2	305	4,739·8	252·77	Not represented.			
	Three-year-old	..	..	..	..				
	Four-year-old	..	..	..	..				
	Mature	4	298	5,249·6	280·51				
Shorthorn	Two-year-old and under ..	Not represented				..	..	..	..
	Three-year-old					..	..	..	..
	Four-year-old					1	219	7,509·4	273·25
	Mature					2	253	6,445·6	239·75

RATIONS FOR WINTERING PIGS.

RESULTS OF FEED-TRIALS AND OBSERVATIONAL TRIALS.

C. P. McMeekan, Massey Agricultural College, Palmerston North.

On the majority of dairy-farms engaged in pig-raising the question of how best to deal with a large proportion of the late-farrowed summer and autumn litters presents many difficulties. Owing to the rapid decline at this period in the supplies of fattening dairy by-products as a result of the seasonal system of dairying practised, it is impossible to fatten to satisfactory marketable weights the whole of the pigs normally on hand. Separated milk and whey are in insufficient supply for the purpose, and, under normal conditions, the use of grain or other concentrates to the extent necessary is unprofitable. As pointed out in a previous paper—(1) The judicious and limited use of concentrates as supplements can play a material part in reducing the number of unfinished animals during this period, and especially is this so when combined with rational control of farrow dates of breeding-stock so as to fit more closely the seasonal supplies of food; (2) useful as these methods have proved, however, they have not offered a complete solution to the problems.

Fattening being out of the question, farmers are faced with a choice between either selling as weaners or light stores in the late autumn at the low prices resulting from the small demand for such animals at this time or of maintaining them through the winter months in a growing condition for sale as forward stores when prices improve in the spring, or to be fattened when milk is again available at the commencement of the new season. The latter method is associated in practice with many difficulties, and, in consequence, tends to be avoided when possible by many producers. Of these difficulties the rationing aspect is only one, but it is one upon which little definite information exists, and which becomes particularly acute during the mid-winter period when milk-supplies either disappear altogether or are required by the breeding-stock. It is apparent therefore that the problem from the rationing angle involves the provision of cheap milk-by-product substitutes suitable for the purpose. With the object of obtaining information on the suitability of certain rations in this connection, and of investigating generally the economy of the practice of "wintering," the following feed trials were conducted by the writer during the winter of 1935, together with certain observational trials carried out with large numbers of pigs under practical farming conditions. It should be emphasized that this work relates not to winter fattening, but to the practice of maintaining otherwise unsaleable pigs in a fit growing condition through a period of feed shortage.

OUTLINE OF EXPERIMENT.

Forty pigs from six litters were taken and evenly distributed between five groups so as to eliminate differences due to strain and weight. The pigs were first-cross Tamworth-Berkshires, and all had a common sire. The trial covered the May–July period. Each group was provided with comparable and comfortable feeding and housing quarters, together with a grass run-out pen.

One group was fed on the normal ration of the farm, and served as a control pen. The remainder were rationed in such a way as to provide comparisons between meat-meal and peas as "winter protein supplements," and between mangels and pumpkins as winter "roots." The actual rations were as follows:—

	Ration per Pig Daily.
Group 1 (Control)—Buttermilk mixture + pumpkins	1½ gallons for fourteen days; 2 gallons thereafter.
Group 2—Barley, meat-meal, and pumpkins	½ lb meat-meal for fourteen days; ¾ lb. thereafter.
Group 3—Barley, peas, and pumpkins	½ lb. peas for fourteen days; ¾ lb. thereafter.
Group 4—Barley, meat-meal, and mangels	½ lb. meat-meal for fourteen days; ¾ lb. thereafter.
Group 5—Barley, peas, and mangels	½ lb. peas for fourteen days; ¾ lb. thereafter.

Barley (whole grain) was fed to all groups except the control at the rate of ½ lb. per pig daily for the first thirty days, and at ¾ lb. per pig daily thereafter.

The "roots" were fed at a standard rate to all groups—50 lb. per group daily in the case of both pumpkins and mangels.

The "buttermilk mixture" used with the control group was a standard mixture used on the farm, and consisted of 200 gallons of buttermilk, 200 gallons of water, 100 lb. of meat-meal, and 80 lb. of molasses.

The meat-meal used was commercial "pure meat-meal" showing 65 per cent. crude protein on analysis.

It will be noted that this arrangement provided the following comparisons:

Group 2 with Group 3—Meat-meal compared with peas in association with pumpkins.
Group 4 with Group 5—Meat-meal compared with peas in association with mangels.
Group 2 with Group 4—Pumpkins compared with mangels in association with meat-meal.
Group 3 with Group 5—Pumpkins compared with mangels in association with peas.

The trial extended over fifty-nine days. Live-weights were taken at the commencement and at the end of the period. These were taken in the morning prior to feeding, the pigs being virtually in an "empty" condition.

RESULTS OBTAINED.

The pigs came through the winter well; health was good, and the animals finished in a thrifty condition. Increase in weight appeared to have occurred mainly through increase in size or frame rather than in condition or flesh and fat. There were no differences apparent in the appearance of the groups, except for a slight advantage in "bloom" of the pigs in the control-pen receiving milk. Little nourishment appeared to be obtained from the grass pens, the pasture being at a dormant stage of growth and tending to disappear under the trampling effect of the animals as a result of wet weather. The following shows the live-weight increases:—

Table 1—Live-weight Increases.

Group.	Initial Weight.	Final Weight.	Gain: Total.	Average Gain per Pig per Day.
	Lb.	Lb.	Lb.	Lb.
1 ..	576 (average, 72·0)	736 (average, 92·0)	160 (average, 20·0)	0·34
2 ..	588 (average, 73·5)	715 (average, 89·4)	127 (average, 16·0)	0·27
3 ..	579 (average, 72·4)	776 (average, 97·0)	197 (average, 24·6)	0·42
4 ..	593 (average, 74·1)	724 (average, 90·5)	131 (average, 16·4)	0·28
5 ..	600 (average, 75·0)	761 (average, 95·1)	161 (average, 20·1)	0·34

Food-consumption results are set out in Table 2.

Table 2—Food-consumption per 100 lb. Live-weight Increase

Group.	Milk.	Pumpkins.	Mangels	Barley	Peas	Meat-meal.
	Gallons.	Lb	Lb.	Lb	Lb	Lb
1 ..	555	1,828	..	..	..	..
2 ..	..	2,322	..	229	..	256
3 ..	..	1,497	..	148	165	..
4 ..	..	..	2,254	223	..	249
5 ..	..	..	1,828	181	202	..

Consideration of Tables 1 and 2 indicates that from the point of view of the suitability of the rations for "wintering" all provided a satisfactory rate of growth as measured by the performance of the control group. Individually, both the meat-meal groups show less efficient results in both growth-rate and economy of food as compared with the two pea groups. Further, it is clear that—Peas gave better results than meat-meal when both were used with pumpkins; peas gave better results than meat-meal when both were used with mangels; pumpkins and mangels gave similar results when both were used with meat-meal; pumpkins gave slightly better results than mangels when both were used with peas.

This superiority of peas over meat-meal is of considerable interest in view of the usual recommendations with respect to these two foodstuffs. The agreement between the two meat-meal groups and the two pea groups respectively is very close, and the difference in growth-rate considerable. In view of the relationship of protein to flesh-production, and of the relative protein content of the two foodstuffs, it is generally believed that meat-meal, with its higher protein content, is the more effective of the two for use with pigs whose principal requirement is one of flesh and bone production rather than one of fattening. It is conceivable, however, in view of the slow growth-rate of the pigs, that the greater part of the ration was utilized for maintenance purposes, and that accordingly much of the protein was unable to fulfil its normal function, but necessarily served as a source of energy. Since on theoretical grounds it is less efficient than carbohydrate for this purpose, it is possible that part, at least, of the difference noted may have been due to this cause. The matter warrants further investigation.

ECONOMY.

Table 3 sets out the actual costs for supplements in each group and the costs in relation to the increase in weight. The latter figures provide a better guide as to the economy of the various rations, though the former are useful in indicating the expenditure involved in wintering pigs with the methods employed.

Barley, peas, and meat-meal are charged for at 1d. per pound, a figure approximating the average price of these foods. The home-grown materials, roots and milk, have not been allowed for.

Table 3.—Relative Costs for Concentrate Rations.

Group	Actual Costs	Costs per 100 lb. Weight Gain
	s. d.	£ s. d.
1	4 2	1 0 1
2	6 6	2 0 5
3	6 6	1 6 3
4	6 6	1 19 4
5	6 6	1 11 11

It will be observed that the cost for purchased milk substitutes in Groups 2 to 5, over a two-month period during which gains of from 12 lb. to 25 lb. per pig were registered, amounted to 6s. 6d. per pig. This figure compares well with the control-pen cost where milk used permitted smaller quantities of concentrates to be employed. The figure excludes the cost of the roots employed, which if added at the rate of 12s. 6d. per ton (a normal commercial value), brings the total food-cost for wintering of the experimental groups up to 8s. 9d. per pig. At this figure all the groups were profitable, the price-margin between an autumn and a spring store pig being well in advance of this figure. The difference in growth-rate of the individual rations is, of course, responsible for the differences in the economy of the individual rations on a cost basis. Here Groups 3 and 5, using peas and barley with pumpkins and mangels respectively, show to advantage.

OBSERVATIONAL TRIALS.

In addition to the above, careful observations were made on two large lines of farmers' pigs being wintered under conditions similar to those of the experimental groups on rations normally employed by the farmers concerned.

Trial No. 1.

In this trial there was a line of fifty-one pigs, born during February–April, and weaned on to carrots and chou moellier prior to coming under observation on the 1st June. From this date until the 1st August the pigs were wintered on a ration of grain, chou moellier, and roots (carrots and mangels). The pigs were weighed at the commencement and at the end of the period, and records kept of the quantity of food given The following results were obtained:—

Initial weight ..	.. 2,819 lb. (average, 55·2 lb.)
Final weight ..	.. 3,682 lb. (average, 72·2 lb.)
Total gain ..	.. 804 lb. (average, 16·9 lb.)
Days on trial ..	.. Sixty-two.
Average daily gain	.. 0·27 lb.

The ration consisted of ½ lb. per pig per day of a mixture of 1 part of crushed barley and 2 parts of crushed oats for the whole of the period. This was supplemented with a run-out on chou moellier for the first thirty-five days (1¾ acres), and during the last twenty-seven days by an allowance of 25 lb. of mangels plus 2 oz. of meat-meal per pig per day. The ration and cost of same per pig for the whole period was thus as follows:—

Ration.	Cost. s.	d.	
Grain mixture, 31 lb. ..	2	7	at 1d. per pound.
Meat-meal, 4 lb.	0	4	at 1d. per pound.
Mangels, 625 lb.	3	6	at 12s. 6d. per ton.
Chou moellier	..		
	6	5	

It was observed during the course of the trial that the larger pigs seemed to thrive better and withstand the somewhat cold and wet weather prevailing than pigs that were small in size at the commencement of the trial. This observation was confirmed by the individual weights; many of the latter showed only small increases in weight, while some even lost weight though increasing in size during the period. A comparison between the rates of gain of "heavy" and "light" pigs gave the following results: Heavy pigs (average, 70 lb.), daily gain, 0·50 lb.; light pigs (average, 47 lb.), daily gain, 0·20 lb.

This observation is of considerable interest, and if substantiated by further investigation will provide a further reason in addition to those already operative in favour of early farrowing, so that pigs will be of sufficient size before the winter commences. It might be noted that the difference between the light and heavy pigs was not due to competition between them for food; feeding was organized in such a way as to ensure each pig obtaining its share of the daily ration.

Trial No. 2.

Two lines of pigs of twenty-nine and twenty-four animals respectively were kept under observation under similar conditions to the above. The trial extended over the same period. The ration consisted of a small allowance of buttermilk daily, which was fed warm (approximately 1 gallon per head daily), supplemented with $\frac{1}{2}$ lb of peas in the case of Lot 1 and $\frac{1}{2}$ lb. of barley in the case of Lot 2. Both groups also received an allowance of mangels of approximately 12 lb. per head per day. The results were as follows :—

LOT 1 (PEAS).

Initial weight ..	.. 2,530 lb. (average, 87 lb.).
Final weight ..	.. 2,937 lb. (average, 101 lb.).
Gain in weight ..	.. 407 lb. (average, 14 lb.).
Average daily gain	.. 0·24 lb.
Days on trial ..	.. Fifty-nine.

LOT 2 (BARLEY).

Initial weight ..	.. 2,270 lb. (average, 94·5 lb).
Final weight ..	.. 2,883 lb. (average, 120 lb.).
Gain in weight ..	.. 613 lb. (average, 25·5 lb.).
Average daily gain	.. 0·43 lb.
Days on trial ..	.. Fifty-nine

It will be observed that the two lots received the same ration apart from the concentrate supplement. The lot receiving barley showed the better growth-rate This difference cannot be considered significant, however, for the two lots were not strictly comparable on a breed and strain basis, while the barley group had a possible advantage through having continuous access to good-quality leafy pasture, while the pea group were provided with soiled pasture of inferior quality.

The data are of interest, however, in indicating the results being obtained in practice with rations similar in type to those of the experimental groups. The pigs maintained a satisfactory rate of growth for the purpose of wintering, and came through in good thriving condition, increasing in value by many times their feed-cost during the period. The cost was low, being that of 30 lb. of grain per pig in each case. At 1d. per pound this gives a wintering charge for purchased foods of 2s. 6d., to which must be added the mangels, at 3s. 6d. per head.

SUMMARY.

The trials discussed show that pigs can be successfully carried over the winter period of food-shortage on a ration of milk substitutes. Mangels and pumpkins as cheap home-grown sources of energy are compared for the purpose, as also are meat-meal and peas, which, as concentrate supplements to a basal ration of roots and grain, are readily available.

Peas gave more efficient results than meat-meal, both with mangels and pumpkins. The latter two foodstuffs gave similar results. The rations employed, however, were sufficient only to maintain the pigs in a thriving condition, and added but slightly to their live-weight. Any increase in weight occurred mainly in respect to size rather than condition.

For the purpose for which they were designed, however, the results indicate that the rations employed present definite possibilities as an alternative to the method of disposal of late-farrowed pigs during periods of low prices.

The results of the trials are supported by observations on large groups of pigs on similar rations under practical farming conditions.

ACKNOWLEDGMENTS.

The investigations reported were carried out in conjunction with the Manawatu-Oroua Pig Development and Recording Club. The thanks of the writer and the club are due to the Cheltenham Dairy Co. for the facilities provided for the feed trails; to the manager, Mr. H. E. Thurston, who carefully carried out the feeding and provided other assistance; to other farmers who co-operated in respect to the observational trials at considerable inconvenience to themselves; and to Mr. W. J. Croucher, recording officer of the Club, for generous assistance in the organization of the work.

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SEED CERTIFICATION.

SUMMARY OF OPERATIONS FOR SEASON 1935–36.

J. H. CLARIDGE, Certification Officer, Fields Division, Wellington.

THE seed certification controlled by the Fields Division of the Department of Agriculture has now been in operation for a period of nine years. This report covers the activities during the 1935–36 season. While no major amendments to the work were made during the period under review, the certification of *Phalaris tuberosa* seed was introduced. The development of the production under certification of supplies of pedigree grass and clover seed has been a feature of the season's activities, while for the first time an appreciable quantity of rape-seed was accepted for certification.

A further increase in the total entries accepted for 1935–36 season, amounting to 30 per cent., has brought the number of crops under certification to the total of over 3,000. This increase has been attributable in the main to a phenomenal increase in entries for seed-wheat certification, and also to quite considerable increases in the entries received in connection with perennial rye-grass and seed-potatoes.

GOVERNMENT PEDIGREE STOCK SEEDS.

One area of perennial rye-grass, and several areas of white clover, sown with specially selected nucleus stock seed, were grown on contract by the Department during the 1935–36 season, the produce of these areas being accepted for certification as " Government Pedigree Stock " seed.

A heavy yield of perennial rye-grass seed was obtained, and the complete harvest, amounting to 800 bushels, was readily disposed of through trade channels. It was unfortunate that the season for white-clover-seed harvesting was very unfavourable, as only two of the areas could be saved for seed, and from these very small quantities of seed were obtained. On account of the short supply many orders for this seed remained unfilled.

It is expected that larger quantities of both perennial rye-grass and white-clover seed will be available from the coming harvest for distribution during June next.

PERENNIAL RYE-GRASS.

The entries into certification in the " mother " and " permanent pasture " classes were, in general, slightly lower than in the 1934–35 season except in the Hawke's Bay district, where the number of entries increased by 100. On the other hand, a complete year's activities relative to the " commercial " class of seed accounted for the examination of 525 lines of seed, representing a somewhat similar number of areas. Over 100,000 bushels of seed (40 per cent. of the total quantity certified) was accepted in this class. The total quantity of perennial rye-grass seed certified during the 1935–36 season (279,000 bushels) is 50 per cent. in excess of the 1934–35 total, and is the greatest quantity yet certified in any one season. It is estimated that over the last three seasons approximately one-third of the perennial rye-grass seed harvested in New Zealand has received official recognition under the certification scheme.

COCKSFOOT.

There has been little alteration in the quantity of cocksfoot seed certified in the 1935–36 season, a lower acreage harvested being almost offset by an increase in the yield per acre. In all, 657,000 lb. of machine-dressed seed was sealed and tagged as certified, two-thirds of this quantity being produced on the Akaroa Peninsula by members of the Akaroa Cocksfoot Seed Growers' Association. Practically the whole of the remaining seed was harvested from the mid-Canterbury district. It is very noticeable that little of the seed certified as " mother " is being used in the establishment of new areas for further seed-production. Most of the seed certified is the produce of older-established areas.

WHITE CLOVER.

The 1935–36 season was exceedingly unfavourable in so far as the white-clover harvest was concerned. As a result, fewer areas were harvested, while the yield per acre was also reduced considerably. A total of 56,000 lb. of machine-dressed seed was certified, as compared with 96,000 lb. during the 1934–35 season.

BROWN-TOP.

While the acreage entered for brown-top certification has remained fairly constant, the yield of seed obtained in the season just concluded has shown a considerable reduction. Only 362,000 lb. of seed was finally sealed, as compared with 634,000 lb. during the 1934–35 season.

RED CLOVER.

As with white clover, seasonal conditions had an adverse effect on the production of certified Montgomery red-clover seed. A reduction in the acreage harvested as compared with the 1934–35 season, together with a yield reduced from 156 lb. per acre to 119 lb. per acre, has resulted in a reduction in the total produce certified from 32,000 lb. to 23,500 lb. In addition, the sample produced has not been as bright in colour as in past seasons. There has, however, been no difficulty in regard to the disposal of all seed harvested under certification, and it appears that a good export trade in this seed might reasonably be expected.

ITALIAN RYE-GRASS.

The certification of Italian rye-grass seed has, in its second season of operation, progressed very satisfactorily. Of thirty-one areas entered, twenty-eight passed field inspection, producing 2,500 sacks of field-dressed seed. Quite a considerable portion of this seed (mostly that certified in the commercial class) was not machine-dressed, so the total of 6,600 bushels of machine-dressed seed rather understates the position. The average yield of this seed was 29½ bushels per acre.

Certified Italian rye-grass seed is meeting with a very favourable reception both in this country and in Australia, where quite a demand has already been created. It is confidently anticipated that the amount of Italian rye-grass seed coming under certification may be increased very many times without fear of exceeding the demand.

PHALARIS TUBEROSA.

Phalaris tuberosa is recognized as a very valuable grass for certain localities in Australia, but a drawback to its wider use is the high price of seed. Last season an attempt was made to produce seed in New Zealand under certification Seasonal conditions were not of the best, and the seed crop in respect of two of the areas was a failure. From a third area 2,500 lb. of seed was obtained from 6 acres, which indicates that the prospect in regard to the production of *Phalaris tuberosa* seed is quite hopeful.

WHEAT.

The acreage under wheat certification during the 1935–36 season was more than double that of the previous season Entries were confined almost entirely to four varieties—Solid Straw Tuscan, Cross 7, Hunter's II, and Dreadnought

Twenty-five thousand bushels of certified seed wheat were sealed and tagged during the 1935 36 season, while a further 10,000 bushels of seed from certified crops was passed at grain inspection, but not submitted for machine-dressing. The rapid dissemination of seed of the Cross 7 variety which has taken place in the last two seasons is very striking and emphasizes the value of seed certification in the speedy distribution of superior stocks of a new variety. In 1933–34 one small area of Cross 7 was under certification while in 1934–35 the number had increased to six crops. In 1935 36 season 105 crops, comprising 1,600 acres, were entered Approximately half this area was accepted for certification, and 10,000 bushels of machine-dressed seed were sealed and tagged in this the third season during which seed of this variety has been available commercially

SEED POTATOES

Entries into potato certification have continued to increase, 686 crops having been inspected in the 1935–36 season, as compared with 513 crops in the 1934–35 season. The percentage of crops to reach certification standard (89·7 per cent.) is the highest on record, having increased from 56·4 per cent. in the 1932 33 season. Over 2,800 tons of potatoes, the produce of certified crops, were inspected after grading and accepted as finally certified seed.

Figures recently published in the *Monthly Abstract of Statistics* indicate that throughout the whole of New Zealand the yield from certified seed during 1936 was 1½ tons per acre (25 per cent.) higher than where uncertified seed had been planted. This independent estimate, based on figures returned to the Statistican by farmers themselves, indicates the true worth of certified seed potatoes.

BRASSICA CROPS.

Four areas of rape, two each of Giant and Broad Leaf Essex type, were sown out in 1935 with seed raised at the Plant Research Station. These areas, comprising 31 acres, were harvested in the 1935–36 season, the produce, amounting to 24,500 lb., being accepted as certified seed. This is the first time that rape-seed has been available to farmers in New Zealand with any reliable assurance as to the type of rape which is being

Table giving Quantities of each Seed certified and Estimate of the Total Value of Seed certified in each Season.

Seed.	Chief consideration upon which Certification is based.		Quantities of Seed finally certified.								
			1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.	1035–36.
Potatoes ..	Varietal purity, cropping-power, and freedom from virus disease	Tons	217	249	511	760	818	938	1,806	1,821	2,823
Wheat ..	Varietal purity and freedom from loose and stinking smuts	Bush.	3,840	11,682	16,714	4,060*	1,283*	7,001	6,012	11,110	25,646
White clover	Age of pasture, 1928–31; type of clover, 1931–35	Lb.	..	10,595	69,015	67,242	6,131*	33,731	20,337	93 381	56,092
Perennial rye-grass	Genuine perennial type	Bush.	..	..	17,052	45,982	81,186	245,667	119,019	182,386	279,305
Brown-top ..	Freedom from red-top (*Agrostis palustris*)	Lb.	..	..	170,071	171,083	198,343	138,843	118,978	384,588	212,734
Cocksfoot ..	Type as exemplified in the produce of Akaroa Peninsula	,,	..	..	..	..	171,720	622,765	200,560	715,982	657,319
Red clover ..	Type conforming to that of English-grown Montgomery red clover	,,	..	..	..	..	1,550	3.763	17.263	32,193	23,620
Brassicas ..	Varietal purity and freedom from disease	,,	..	..	..	..	..	..	22.515	522	24,503
Italian rye-grass	A rapid-growing high-producing type, showing recovery after cutting	Bush	..	..	..	..	..	..	..	5,121	6,669
Phalaris tuberosa	Freedom from other species ..	Lb.	..	..	..	..	..	..	..	..	2,701
Estimated value of seeds finally certified	..	..	£2,070	£4,889	£30,328	£40,048	£57,358	£142,585	£79.018	£154,725	£184,501

* Reductions accounted for by changes in regulations.

Total estimated value of seed certified (1927–36), £695,522.

purchased. The additional benefit of freshness is a further factor for consideration in the purchase of this seed. In addition, the yielding-capacity of the strains of seed to be distributed in coming seasons is superior to that of commercial samples, so that there is every reason to believe that purchasers of rape-seed will avail themselves of this article locally produced under certification.

GENERAL.

In the accompanying table are recorded the quantities of the various seeds certified since the inauguration of certification in 1927, together with an estimate of the value of seeds certified in each season. Attention is drawn to the fact that this table includes only seed in a machine-dressed or graded condition, and does not include seed harvested but not submitted for machine-dressing, or, in the case of potatoes, seed not submitted for tuber inspection. Persons or firms interested in the complete tabulated results may obtain copies of these on application to the Director, Fields Division, Department of Agriculture, Wellington.

WOOL-PRODUCTION.

INFORMATION as to production of wool is not obtainable directly, but it is possible to compute fairly accurate figures on the basis of exports and local consumption during the twelve months ended 30th June, and the variation in stocks revealed by the annual census of stocks of wool held on 30th June

In the following computation of total production, scoured, washed, and slipe wool has been converted to a greasy basis on the assumption of an average loss of 33⅓ per cent in weight, while wool exported on skins has been taken at an average of 4 lb per skin.

—	Year ended 30th June,						
	1930	1931	1932.	1933.	1934.	1935.	1936.
	Million lb.						
Exports of wool	207·2	244·3	248·1	310·0	308·9	222·3	344·1
Exports of wool on skins ..	4·8	6·4	6·8	11·1	14·4	9·0	8·2
Used by New Zealand mills ..	6·1	6·2	7·0	6·6	6·0	7·1	7·8
	218·1	250·9	261·9	327·7	329·3	238·4	360·1
Variation in stocks	+54·8	+14·2	+20·9	−39·3	−28·8	+37·5	−43·6
Estimated production ..	272·9	271·1	282·8	288·4	300·5	275·9	316·5

The collection of wool statistics has been reorganized on a basis which permits of the application of the above formula for ascertaining total wool-production for each season from 1929. It will be seen that the latest figure of 316,500,000 lb. is easily the largest recorded during the period shown. Records prior to the 1929 season (although not on a strictly comparable basis) indicate that the 1935–36 figure has never been exceeded in any season in New Zealand's history.

The high production of wool last season may be attributed to the very favourable conditions experienced during the period of growth, assisted by late shearing operations due to a wet summer. It is now evident that, on the average, the relatively high yield of over 9 lb. of wool per sheep was obtained at shearing.

IMPORTATION OF FERTILIZERS IN YEARS 1934-35 AND 1935-36.

THE following particulars of the importation of fertilizers into New Zealand for the years ending 31st March, 1935 and 1936, have been compiled by the Inspector of Fertilizers, Fields Division, Department of Agriculture, Wellington, from returns furnished by courtesy of the Comptroller of Customs:—

Table I.—Summary of Fertilizer Importations, 1935–36 and 1934–35.

	Quantity (in Tons).	
	Year 1935–36.	Year 1934–35
Bonedust and bone-char	30	80
Basic slag	51,390	9,217
Seychelles soft-phosphate*	5,879	22,089
Nauru and Ocean Islands phosphates ..	209,751	170,838
Island phosphate (other)†	8,815	3,304
Egyptian phosphate	1,000	1,400
Phosphate (not otherwise specified)‡ ..	7,405	10,237
Kainit	845	840
Muriate of potash	75	262
Sulphate of potash	838	733
Potash salts (other)	7,076	7,386
Sulphate of ammonia	4,033	5,100
Nitrate of soda	1,620	1,511
Fertilizers unspecified	175	95
Sulphate of iron	23	10
Totals	298,955	233,102

* Includes all soft-phosphates from Seychelles Islands and islands in vicinity † Soft-phosphates from New Caledonia, includes 55 tons from Peru year 1935–36 and 25 tons year 1934–35 ‡ Chiefly from Belgium—presumably North African phosphate mined in Tunisia and ground in Belgium

Table II.—Imports of the Principal Phosphatic Fertilizers, 1927–36.

Year ended 31st March,	Bonedust and Bone-char.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons	Tons.	Tons.	Tons	Tons.	Tons.
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	1,000	35,348	37,424
1931 ..	795	67,766	..	156,950	..	8,038	250
1932 ..	180	47,776	300	178,466	..	..	4,738*
1933 ..	30	42,022	..	214,445	160	..	6,024*
1934 ..	..	14,982	..	182,333	350	..	5,437*
1935 ..	80	9,217	..	196,231	1,400	..	10,237*
1936 ..	30	51,390	..	224,445	1,000	..	7,405*

* Includes phosphate (not otherwise specified) which is chiefly North African phosphate ground in Belgium.

SEASONAL NOTES.

THE FARM.

Subterranean Clover.

DURING recent years attention given to field experience in New Zealand with subterranean clover has resulted in a considerable knowledge of its value in our farm economy and its appropriate management under various conditions. It has been established that subterranean clover may be made of outstanding value under a wide range of conditions of soil and climate. The position in the North Island in this respect is discussed elsewhere in this *Journal*. In the South Island the results of pioneering work described by Neave and Hewlett in the September, 1935, issue of this *Journal* has been repeated in essential features elsewhere, and the current available information points to the future development along the drier eastern portions of the South Island of what may be called a "subterranean clover belt," on account of the fact that subterranean clover will hold a key position in building and maintaining the fertility and production of the belt. A similar belt along the drier eastern portions of the North Island is already in its early stages of formation. The utilization of subterranean clover in the drier eastern portions of New Zealand promises to parallel to a large extent what has been done in correspondingly dry portions of Australia.

The outstanding value which has been shown to attach to subterranean clover in certain of our drier areas is due primarily to two facts (1) it is a broad-leafed edible palatable legume, (2) it is a freely reseeding annual the vegetative activity or growth-period of which naturally coincides with satisfactory supplies of water in the soils, and largely avoids inadequate supplies—the plant is vegetatively dormant only for some weeks during mid-summer, and it is during this period that the supplies of soil moisture are normally lowest.

Its being a legume ensures not only that it is practically independent of supplies of nitrogenous matter of which the extensive open soils of the dry eastern districts are so deficient as to be unable, as a rule, to produce economic yields of most other crops, but also that the content of nitrogenous organic matter of such soils is increased relatively rapidly by thriving crops of subterranean clover. As a result the general fertility of such soils becomes so improved that eventually they become capable of supporting successfully plants of high requirements in respect to fertility, such as perennial rye-grass and cocksfoot, which could not be grown profitably on such soils in their natural state.

Its being a broad-leafed edible palatable clover makes it an appropriate component of the rations of milk-producing stock, be these sheep, cows, or pigs, and its high value for such stock has been demonstrated.

Subterranean clover, being an annual which freely resows itself, becomes, for practical purposes, a perennial crop with which is associated the low cost of annual upkeep that is found so attractive economically in those crops such as prolific permanent pastures and lucerne in which establishment costs are spread over the production of a series of years. The standard of natural or unimproved production of the soils of the eastern districts on which subterranean clover is being used successfully is so low as to discourage greatly the culture of any crop calling for relatively high annual cost of upkeep such as is almost necessarily linked with frequent sowing of crops. Prior to the use of subterranean clover no satisfactory method of substantially improving such soils fairly rapidly has been practised.

The fact that subterranean clover when suitably nourished and utilized normally provides leafy, very nutritious feed during most of that portion of the year between late summer and the following mid-summer is indicative of its potentialities in both sheep-farming and dairying. It provides leafy feed for practically the whole period during which such feed is especially required in fat-lamb production. The gap in its production in summer is of importance in dairying: a measure that is effective in assisting to bridge this gap is the provision of an area of lucerne under conditions suitable for lucerne culture—lucerne produces well just when the production of subterranean clover is at its lowest.

Outside the relatively arid areas of about 30 in. of annual rainfall or less, subterranean clover has proved valuable especially because of its production, from autumn to the following spring inclusive, on poorish somewhat heavy soils, as well as on open soils.

A fairly wide field experience in the sowing of subterranean clover can now be drawn upon. Only a very limited amount of spring sowing has come under notice, and this has not been successful. On the basis of results, late summer or early autumn sowing rightly is favoured. Usually, if not always, successful results have been linked with the application of phosphates which may be considered essential in the most profitable use of subterranean clover.

On worn, open pastures success has followed the broadcasting on the surface of 1 lb. of seed an acre; under similar conditions better and quicker returns have been obtained from increasing the seeding to 2 lb. an acre, and it is considered that still more attractive economic results are obtainable under the same conditions from the use of up to 4 lb. an acre of seed, although on this point no definite data are available. Surface broadcasting of seed in poor but nevertheless compact swards has on several occasions given disappointing results, and when ploughing of such swards prior to the sowing of subterranean clover is practicable it is recommended.

Because of the difficulty of keeping white clover in a pasture dominated by paspalum, it is at times advisable to introduce into such a pasture subterranean clover, which serves usefully in conjunction with paspalum. Hence when a special paspalum pasture is being established it is as a rule advisable to include ½ lb. to 1 lb. of subterranean-clover seed an acre Much greater quantities of subterranean-clover seed, ranging up to 6 lb. or 7 lb. an acre, have been used in conjunction with paspalum, but whether they are justified seems to be a matter of opinion—they may be expected to lead to quicker prominence of the subterranean clover.

On light country in eastern districts of the North Island, 2 lb. to 5 lb. an acre of subterranean clover have been added with beneficial results to practically standard seed-mixtures for permanent pastures suitable for such land; the tendency is to favour the larger quantities of subterranean clover. For the purpose of obtaining special subterranean clover areas, 5 lb. to 10 lb. an acre of subterranean clover sown alone or in conjunction with 20 lb. to 30 lb. an acre of Italian rye-grass has given good results.

In Canterbury, on the farm of the Canterbury (N.Z.) Seed Co., Ltd., near Leeston, a mixture of 10 lb. to 12 lb. of cocksfoot and 2½ lb. to 3 lb. of subterranean clover an acre has proved quite satisfactory.

Experience suggests for the West Coast of the Wellington Province and for localities with similar conditions the use of 2 lb. to 4 lb. an acre of subterranean clover, both for broadcasting on existing swards and for inclusion in mixtures to be sown on cultivated ground. The tendency to favour the larger amount of seed increases. As in the eastern districts of the North Island, for obtaining quickly a special subterranean clover area the use of 5 lb. to 10 lb. of subterranean-clover seed an acre is considered advisable. Specific guidance about the use of subterranean clover under particular conditions and for particular purposes is obtainable from local officers of the Fields Division.

Autumn Top-dressing.

On many farms some at least of the pastures advantageously may be dressed with phosphates in February or thereabouts. When the supply of moisture in the soil is sufficient to admit of growth, then the application of phosphates at the time mentioned usually increases the leafy growth of pastures from shortly after the phosphates are applied until well into the beginning of winter. Hence the feed position during the critical winter and early spring period is strengthened. Further, during the following spring and summer, the stimulating influence of the phosphate continues, although not so intensely as if the phosphate were applied in the winter or early spring. Hence the application of phosphates in the late summer or early autumn tends to a more even growth of grass throughout the year than does the spring application of phosphates, and therefore efficient grazing management of pastures can be obtained more easily under autumn application than under spring application of phosphates. It should be borne in mind, further, that both autumn application and spring application of phosphates increase the absolute gap between the peak of high production and that of low production of permanent grassland, and that both therefore intensify the need for provision of special feed for use during the critical periods in which the amount of feed directly available from grassland is customarily below the current requirements of the stock, unless substantial under-stocking is practised.

Preparation for Autumn Sowing of Pastures.

On many farms a summer task of prime importance is the preparation of ground for the autumn sowing of pastures In this task many seem to appreciate but imperfectly the great value of thorough cultivation in the production in the seed-bed of the fine firm condition which so usefully fosters successful establishment of seedlings The value of firmness of seed-beds is indicated to some extent by the superior pastures that often are found along " headlands " of fields or along tracks where there is greater consolidation than in the remainder of the field, this being due to additional passage of stock or of machinery. The advisability of fineness in the seed-bed may be realized readily by considering what must be the fate of many of the small seeds used in pasture-seed mixtures when the soil is in a coarse or lumpy condition : any of these small seeds covered by lumps cannot with their limited supply of energy push their shoots to the surface.

In districts in which the ravages of the grass-grub have been much in evidence during recent seasons, it is inadvisable to sow pastures in land which in the immediate past has been occupied by a cereal or by grass. On the other hand, the more land was without a plant-covering from November to December, the period in which the eggs which develop into the grass-grub are deposited in large numbers, the more likely is the land to be free from the grub during the following twelve months.

Control of Pasture-growth in Summer.

Widely more attention than is given should be given to the quality of the feed which is provided by the pastures in summer. This matter is of special importance in dairying. The crux of the position is the fact that the quality of the feed provided by pastures is governed to a large extent by the stage of maturity of that feed. Stemmy or woody growth such as results when flower-stalks are allowed to develop is of low feeding-value. This explains why, at times, the production of dairy stock falls off at an unduly rapid rate, or lambs fail to develop satisfactorily when the animals seem to be in the midst of plenty.

Further, the development of flowering parts in pasture-plants not only leads to a considerable decrease in the nutritive value of the feed, but also is connected causally with a considerable falling-off in the rate of growth :

it seems natural for plants which have flowered and matured to become quiescent for a period, and during this period supplies of leafy feed may be undesirably scant. In February " topping " of pastures by light mowing may be advisable in the interests of feed-quality: in this " topping " the aim should be to remove merely the portions of the sward which are rank or producing seed, in order to stimulate the production of fresh leafy growth from the base of the " topped " plants. Somewhat close mowing, especially if the conditions at the time are dry or become dry shortly afterwards, may be definitely harmful. Appropriate mowing of pastures may also serve usefully at this stage to remove shade-creating parts of such weeds as docks, thistles, red-shank (willow-weed), and fat-hen. If these weeds are not dealt with they are likely to weaken greatly the pasture-plants in their vicinity, and probably to create vacant patches on which, later on, inferior plants become established.

" Topping " in the manner just specified is likely to be especially effective in the production of leafy growth when it is carried out in conjunction with top-dressing as already discussed. Attention to such matters as " topping " and summer top-dressing is particularly advisable on the part of those whose policy it is to depend more and more upon pastures for the feed for their stock. On the other hand the use of such crops as soft turnips and rape, which are markedly low in woodiness and high in digestibility when used at an appropriate stage, offsets excessive woodiness due to over-maturity in the portion of the ration obtained from pastures. Only leafy pasture-growth, low in stemminess or woodiness and high in digestibility, can efficiently replace standard successful summer supplementary crops such as rape and soft turnips. Whether such leafy pasture-growth in practice can or should be made wholly to replace summer supplementary crops is a management problem to which probably no generally valid answer can be given, and about which we are not at present directly concerned.

Work with Special Crops.

The sowing of certain special crops in late summer is at times distinctly advantageous. For instance, land from which a cereal crop has recently been harvested if sown without delay in Italian or Western Wolths rye-grass (25 lb. to 30 lb. an acre), and red clover (5 lb. to 6 lb.) usually provides autumn and winter feed that is likely to be distinctly useful, especially to sheep-farmers under Canterbury and similar conditions The use of cereal crops as catch-crops productive of winter feed was discussed last month in these notes, which continue to be seasonable.

If arable land is known to be foul with the seeds of annual weeds such as fat-hen, spurrey, and nightshade, which germinate in the spring or early summer more freely than at other seasons, then the cropping of such land should be planned so that the land is sown in the autumn when the crop may be more likely to become established without the grave competition from such weeds against which spring-sown crops are almost certain to have to struggle.

Young lucerne sown in November or December is often fit for mowing in February, but it should not be mown until flowering has commenced, unless weeds threaten to weaken the lucerne-plants by the shading that they cause. Mowing prior to flowering militates against the development of the root-system, and persistent sturdiness and heavy yield of lucerne is associated with an extensive root-system. Usually top-dressing lucerne with phosphates in summer profitably increases its vigour.

The effective use of special summer feed grown to supplement the pastures is of importance and is discussed in these notes in last month's *Journal*, which suitably may be considered for current guidance.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Seasonal Spraying.

MANY growers throughout the Dominion make a very serious mistake by discontinuing spray applications many weeks too soon Presumably this is done for economic reasons, it being considered that the cost of spraying towards the latter part of summer and early autumn is not warranted. This view, however, is a " penny-wise and pound-foolish " one. The discontinuing of spray applications too early in the season inevitably results in a far greater percentage of rejected fruit during the process of grading. The result of a few insect stings, injury of leaf-roller caterpillar, or pinhead black spot, individually or collectively, is all that is required to reduce otherwise extra fancy fruit to the reject class. In view of these circumstances it is recommended that pip-fruits be sprayed as recommended in the November notes, for the control of black spot, leaf-roller caterpillar, and codling moth. If red mite is still prevalent it will be necessary to spray with summer-oil 1–80.

In order to reduce spray residue, early varieties of apples, such as Gravenstein, which are intended for export, should not be sprayed later than fourteen days previous to picking.

Stone-fruits should still receive attention by periodical applications of the sprays recommended in last month's notes.

Harvesting the Crop.

The importance of care in the preparation of fruit for either local or export markets cannot be emphasized too strongly, as considerable losses accrue through faulty handling during the picking, grading, and packing operations

The packing of the crop calls for considerable discretion and care on the part of the picker. Carefully picking to size and eliminating the obvious culls greatly facilitate the work in the packing-shed. Rejected and fallen fruit should not be allowed to remain on the ground, but should be gathered, and if not utilized should either be buried deeply or burned.

Attention should also be paid to maturity, and several pickings should be made ; the fruit should be removed when it has reached the required degree of ripeness for the market it is intended to supply. The more distant the market the earlier the fruit should be gathered to ensure its arrival on the market in good marketable condition In gathering fruit for export attention should be directed to the degree of maturity rather than colour. Much has been written about the necessity of picking to colour and colour standards, but this is apt to be misleading to the grower or picker, as, while the fruit remains on the tree to attain a high colour, it may become over-mature for transport to the market.

Select early picking is of great benefit, as the removal of the mature and larger fruit accelerates the " sizing-up " of those remaining, and also tends to improve the colour of such fruit. The fruit should be removed carefully without damaging the fruit spurs or tearing out the stalks from the fruit. When picked the fruit should not be left standing in the sun, but removed as soon as possible to the packing-shed.

A simple and reliable test for the maturity of apples is made by cutting an apple in half from cheek to cheek, and if the main vascular bundles are linked up the apple is not sufficiently forward to pick. Once the points are unlinked, however, the apples are sufficiently mature for picking.

Budding.

When weather conditions are suitable and little difficulty is experienced in lifting the bark, budding may be proceeded with. When budding stone-fruits it is advisable to make the horizontal cut at the bottom and the vertical cut to go up instead of down (as in the usual practice of budding), as this lessens the gumming which so often occurs when budding stone-fruits.

Fireblight.

A sharp lookout for twig infection by fireblight should be kept where blossom infection was experienced. It is usually from the sappy growths that ooze develops, and their cutting-out and destruction helps materially towards preventing subsequent extension of the trouble. Care should be observed in keeping the pruning secateurs sterilized, and large cut surfaces should not be left unprotected. These should be covered with a bitumen emulsion or other suitable material.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus Notes.

Disease Control.—Provided the weather has been hot and dry, citrus red scale, if present on the trees, will be hatching freely in most districts. An application of summer-oil 1–33 should be applied forthwith (see December Notes). Where infection is at all extensive, at least two applications should be made at an interval of about one month. Thorough spraying is essential, and occasionally operators should examine a tree which they have just sprayed. If it has been done properly there should be no dry spots on any part of the trees, especially underneath and on top of the foliage, all branches, fruit, trunk, &c. Experienced growers who have taken the trouble to make this examination have often been surprised to find that portions of trees which they had thought to be well covered have received little or no spray. Now that the rush of spring work is over, a further examination of the trees should be made for bark blotch and borer, and where these are detected appropriate action should be taken. Any old wounds which are showing signs of losing their protective covering should be "gone over" again with bitumen emulsion or tar. If the latter is used, a mixture of coal-tar and Stockholm tar in equal proportions is the best.

Green Manuring.—It is now time to give consideration to the important matter of green manuring. To obtain the greatest amount of growth from green crops for ploughing under in the spring, the seed should be sown early enough in the New Year to catch the first break in the dry weather and while the ground is likely to remain warm for a further two or three months. Generally, early February is a good month in which to sow lupins, either blue or white, field peas, tares, oats, or whatever is decided upon as being most suitable for the grower's particular district. It appears to be agreed universally that one of the main requirements of citrus trees is organic matter or humus. In the older groves it is difficult to grow an adequate supply of green material between the rows owing to the spread of the trees and the continual tramping-down of the soil which takes place due to the fact that picking of lemons is carried on almost continuously. In those cases where the crops cannot be grown satisfactorily between the trees, it is necessary to consider growing them on adjacent ground and carting the material on to the orchard. Owing to this difficulty of growing green crops in a mature citrus grove (particularly in the case of lemons), the importance of the ploughing-in of cover-crops in the first few years from planting, while the space is available, should not be lost sight of. The tendency to use the space between young trees for revenue-producing crops to the detriment of the supplying of humus should be resisted. Where cowyard or sheep manure is available it should be used in large quantities.

Young Trees.—Young trees require attention during the hot dry weather. Light cultivation should be continued, and, if the rainfall is not sufficient to keep the foliage from wilting, a good watering may be the means of assisting the trees to become well established. Watering, like most beneficial things, can be harmful if it is overdone. Water lowers the temperature of the soil, and continual applications without sufficient intervals for aeration and warming the ground cause a slowing-up of growth. If some of the trees are not doing as well as others, thought should be given to the cause of this condition, and, if possible, a suitable remedy applied. There may be weak spots in the shelter-belts, and where a number of young trees are exposed to strong winds it pays to shelter these individually by means of stakes and scrim. Some growers are under the impression that it is only the cold winds which cause damage, but this is not so, as hot winds or even temperate ones do just as much harm if the necessary force is behind them. The writer wishes to place special emphasis on this matter of sheltering young citrus trees, as several instances have come under his notice where blocks of the best trees procurable in the country have made no progress whatever during the past two years owing to their exposure to high winds. The aim of the grower is to get the trees into profitable production as early as possible. It is quite evident that a small expenditure for the purpose of supplying additional protection in the early stages of the orchard is repaid many times over by way of earlier and larger returns of fruit. The matter of fertilizing the young trees needs further consideration. Here again as with the water, care should be taken to see that this is not overdone. Dressings of artificial manure should be small and distributed over an ever-increasing area extending outwards from the tree-trunk. One application per year of superphosphate and potash should suffice. Nitrogen, in the form of sulphate of ammonia or nitrate of soda, may be applied with advantage twice a year, in September and again about January, using for trees in their first year slightly under half a pound well distributed at each application. Quickly acting nitrogen should not be applied late in the autumn, on the grounds that it may keep the young growth moving until the frosts arrive, with consequent damage to the tender shoots. For the first year the growth made by young orange-trees may be disappointing compared with that made by lemons under similar conditions, but this is to be expected, as orange-trees often take about a year to become established. Pruning in most cases should be confined to the removal of growth which appears below the bud, and, in the case of shoots which are too rank, a light pinching-back may be practised; but for the first year the trees should have almost a free hand to put on growth which will help them to become firmly established. Even light laterals which are obviously too low down to be of use for the permanent limbs of the tree should be allowed to remain in the meantime, as they may afford useful shelter from the rays of the sun during the hot weather. In cases where the shape of the tree is such that the trunks are exposed to the direct rays of the sun it is advisable to paint them with whitewash. This reflects much of the heat and keeps the limbs more nearly at air temperature. A good formula for whitewash is fresh rock lime, 10 lb.; salt, 1 lb.; flowers of sulphur, ½ lb. While the lime is slaking, add the salt and the sulphur, later thinning to the desired consistency.

Grading and marketing Lemons.—Although most citrus-growers forward their fruit to a central packing organization which cures, grades, and markets it on their behalf, there are still a number of growers who are curing and packing their fruit themselves. A number of these do not appear to be conversant with the regulations relating to the sale for consumption within the Dominion of New-Zealand-grown fruit. A précis of the regulations may assist in clarifying the position for those not acquainted with their provisions. All lemons sold on the market must be contained in standard packages which shall be branded with the registered number of the owner of such fruit and marked with either the words "cured" or "not cured." The words "New-Zealand-grown Lemons" must also be branded on each case. If the word "cured" is used (and it is compulsory to use either "cured" or "not cured"), then the lemons must be graded into one of the five official grades for lemons—viz., Extra Fancy, Fancy, Good, Small Grade, or X Grade, and the grade mark, together with the count, branded on one end of each case. Lemons for inclusion in any grade shall have a minimum juice content of not less than 25 per cent. by volume. For information as to the requirements of the various grades, the grower should apply to the Orchard Instructor for his district.

—*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

The Moult.

NATURE'S way of assisting fowls to keep in a clean and sanitary condition is for them to shed their old coat and grow a new coat of feathers each year. This process is known as moulting. Practically all fowls moult once each year, while occasionally some moult twice in the course of twelve months, and what is known as a neck moult is not uncommon at almost any season of the year. Some very heavy producers go for two years without shedding their feathers, but this is abnormal, and it is wiser not to breed from such birds until they have moulted and rested

Though the growth of feathers may take place at any time, the usual moulting-period is at the end of the laying-season, which, generally speaking, is during February and March. The average time it takes a healthy eighteen-months-old bird to get through the moult is from eleven to thirteen weeks. There is, however, a considerable difference in the time and manner in which birds shed their feathers, a good deal depending upon the age of the birds, when they were hatched, their health, and how the birds have been fed. The weather may also have an influence upon the time the moult may start

Two-year-old and three-year-old birds usually take longer than younger birds, while some continue in the moult a long time, which may be taken as a sign of a weak constitution, or that such birds were over-fat or in too poor condition when the moult started. As a rule the poor producer starts shedding its feathers first, and takes a good deal longer to resume laying than the more prolific birds. On the other hand, the strongest and best producers in a flock are usually amongst the last to start moulting, and such birds often shed nearly all their feathers at once, grow their new coat, and start laying again in eight or nine weeks.

The greater majority of hens cease laying during the moulting-period, but at times a few birds produce a few eggs throughout.

Any sudden change or shortage of feed or water is likely to bring on an early or false moult; especially is this so with pullets that have just started to lay, or with hens towards the end of the year.

The usual order in which a bird moults is first the neck, then the back, wings, and body. If a bird is caught and the wings examined it will be found that the wing feathers are divided into two sections by a short feather known as the axial feather. On the outer side of the axial feather will be seen ten primary feathers which are used when flying, but which are out of sight when a bird is at rest. On the inner side are the secondary feathers which are more or less visible when the wings are folded. When a general moult starts the primary feather next to the axial feather in each wing is moulted first, and about two weeks later number two primary is dropped, and so on until the ten primary or flight feathers in each wing are moulted. It is seldom that more than two flight feathers from each wing are dropped at the same time, for this is nature's way of so providing that although a bird is going through the moulting process it can still fly and so protect itself against its natural enemies. It takes on an average about six weeks for a feather to grow to its full size.

Although the process of moulting is a natural and healthy one, it is a drain upon the system, and, as over-fat birds or those in poor condition do not moult well, it is advisable to examine the birds, and, if some of them happen to be over-fat or a little on the thin side, they can be separated from the rest and treated suitably in order to bring them into the best condition to get quickly through the moult.

Care should be taken to see that they are free from insects; a little nicotine sulphate applied to the perches or the dusting of the birds with a fine dusting-material should rid them of vermin. It is also desirable just before or when the moult has started to treat the flock for internal parasites, which may be done by first starving the birds for about twenty-four hours, then feeding a mash of equal parts of pollard and bran, in which has been mixed a teaspoonful of Epsom salts to each three birds, and one teaspoonful of spirits of turpentine to every five birds.

The amount of turpentine required should be first mixed with the bran. Epsom salts should be dissolved in hot water, and when the salts are throughly dissolved and when the water is cold the solution is used to moisten the bran and pollard. It is well to note that best results are obtained when the mixture is given cold.

Feed when Moulting.

When casting their feathers birds do not have great appetites, but care should be taken to see that they get sufficient. However, as the moulting process advances there is a heavy strain on the system, and a more liberal supply of food is required. If insufficient food is given the growth of the new feathers is checked, but care must be taken not to fatten the hens. Though a liberal quantity is required at this time, the ration need not be so strong as that given when the birds are in full lay.

A mash made up of two measures of pollard, one measure of bran, 2 per cent. linseed-meal, 5 per cent. of meat-meal, and, twice a week, a tablespoonful of flowers of sulphur to each twenty fowls should give good results during the moulting period The grain mixture may be made up of equal parts of wheat, barley, and broken maize.

It is important to see that a regular and liberal supply of succulent green food be given. As the moulting process is a natural one, if the quarters are kept clean and dry and the birds fed regularly they will pass through with little trouble. However, extra care and attention during that time assist nature and are amply repaid.

Forcing the Moult.

Plants have been visited where to benefit from the season of high prices for eggs poultry-keepers have tried forcing some of their hens into an early moult with a view to their coming back to lay early. In some cases this has been more or less successful, but on more occasions the results have been most unsatisfactory. In one instance 130 yearling hens were separated from the rest of the flock about the middle of December. Their mash was discontinued, and only a little more than half ration of grain was fed for about three weeks. When the moult was fairly under way they were liberally fed. The result was that by the middle of March the 130 hens were producing 50 eggs per day, and by the end of March 80 eggs per day. This production was maintained during April, but fell to 60 by the 1st May, and by the end of May 50 eggs per day were being produced, and by the end of June 40 per day were being laid. From experience the writer would recommend allowing the birds to go through a natural moult.

Export of Eggs.

During the past egg-export season a total of 11,281 cases—338,430 dozen—eggs were shipped from New Zealand to London, compared with 11,915 cases—357,450 dozen—during the 1935 season. The quantities from the respective centres were as follows: Auckland, 1,928 cases; Canterbury, 5,953 cases; Otago, 3,400 cases—of thirty dozen each.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Extracting.

EXTRACTING should now be in full swing in all districts. Where operations for any reason have been delayed care should be taken to see that the bees are not crowded, or they will commence to loaf, and the ultimate crop will be small. It is advisable to extract twice during the season, but where the beekeeper prefers to defer the work until the end of the flow a close watch should be kept so as to provide ample room which, however, can be done only where large numbers of spare combs are kept on hand. It is during the season when honey is coming in freely that the beekeeper realizes that his most valuable assets next to his bees is a good stock of extracting-combs. Every effort should be made to get at least twenty spare combs for each hive in the apiary, and with this number always on hand the bees are not likely to be hampered for room.

In the absence of plenty of drawn-out combs the best plan is to keep the extractor going, and thus prevent the bees from blocking the brood-combs. This usually happens unless ample room is provided, and as a result the queens are prevented from laying to their utmost, and the colonies dwindle. At no time during the working-season should the work of the queen be hindered. Care should be taken at all times to see to this important item during the flow. The honey is quite ready to extract when the combs are a half to three-quarters capped, but great care should be taken not to extract unripe honey. Numerous instances have come under notice where the practice of taking unripe honey has meant a total loss to the beekeeper.

Removing Honey from the Hive.

The usual practice followed when the time for extracting is at hand is to remove the frames one by one. If excluders are used much time is saved in picking over the combs. As the combs are taken from the hive shake the bees in front of the hive, brush off the remaining bees, and place the combs in a super for removal to the honey-house. The combs should be covered with a cloth which has been previously placed in water containing a small proportion of carbolic acid. When the season is at its height very little trouble is experienced from robbers, but in case of a stoppage in the flow the foregoing precaution is necessary. At all times the beekeeper should study his working equipment, and this is specially important when removing the honey. It will be found convenient to provide a good barrow or truck for carrying at least two full supers. Much time and labour will be saved in this way, and the tedious work of removing the honey will be facilitated.

Uncapping.

One of the most important processes in the work of extracting is that of uncapping. There are several kinds of knives for the purpose on the market, but the stiff-bladed double-edged Bingham is usually first favourite. Two of these are necessary, and they must be placed in a pan of water which is kept boiling on a small lamp. Each knife as it becomes cold is returned to the boiling water, and the hot one takes its place. Any contrivance which is used for an uncapping-can should be provided with a cross-bar through which to pass a screw or similar article, driven point downwards, to form a pivot on which to rest and revolve the combs. The comb should be placed with one end resting on the pivot and tilted slightly forward, in order to allow the cappings to fall away from the comb. Uncapping should commence at the bottom of the comb, and proceed with a sawing motion from side to side until the top of the comb is reached. The comb is then swung round on the pivot and the reverse side treated in the same manner. Only a thin sheet of wax should be removed, but it must be done thoroughly so that every cell is opened, and at the same time the top and bottom bars should be relieved of any burr-combs which adhere to them.

Much in favour with progressive beekeepers is the steam-heated knife. This is a Bingham knife with a soldered copper plate so arranged that steam is forced through it from a rubber tube attached to the spout of a " bronchitis " kettle. An escape-tube is fitted to the opposite side, and the knife is kept at a very high temperature all the time uncapping is proceeding, thereby obviating the work and trouble of continually plunging the knives into boiling water. For uncapping heavy fully capped frames it has no equal, since an ordinary uncapping-knife becomes cold as a rule before half one side of a full comb has been uncapped.

Strainers.

It is not uncommon to find exposed for sale honey with which proper care and attention have not been paid to straining at the time of extracting. Nothing checks the sale of extracted honey so much as a layer of wax-particles, dead bees, &c., and it is surprising how few beekeepers take the necessary trouble to see their product reaches the customer free from wax and other impurities. In no case should honey be run direct from the extractor into the containers: it should be properly strained. It is the attention paid to this necessary detail that aids in the sale of the crop, and when the honey is properly treated it readily commands a higher price. Fine-gauge wire strainers are usually adopted, but even these are not sufficient to remove the smaller wax particles In order to ensure perfect condition the honey should be passed through good fine cheesecloth before being run into the tank. Cheesecloth strainers are excellent, cheap, and are easily made, while at the same time they can be readily cleansed. They remove everything but the smallest particles of wax, which should be finally disposed of when the honey is skimmed This latter process is an important one, and should always be carried out before the honey is put up in marketable form

Superseding Queens.

All old and failing queens should be superseded. It is a good plan to utilize surplus queens carried over in the nucleus hives to do the work. When due attention is given to requeening the apiary there is less likelihood of queenless hives in the spring. Remove all old queens in the apiary, and especially guard against wintering any colonies not headed by a vigorous mother.

Treatment of Foul-brood.

As advised last month, no effort should be spared to treat all colonies known to be affected with foul-brood. If the work is delayed the colonies will not build up to sufficient strength to winter safely. Under no circumstances should the work be put off. Treat all infected stocks while the flow is on, and endeavour to winter none but clean colonies. There is a great risk of spreading the disease to clean colonies in the off-season, as robbing is more apt to break out. " Keep your bees clean " should be the maxim of every beekeeper. Where any doubt exists as to the complete absence of foul-brood in the apiary, an excellent plan is to mark all combs with the number of the hives to which they belong, so that when extracted they may be returned to the colony from which they were taken. If this plan is followed, even if any of the hives are diseased, the risk of spreading infection by means of wet combs will be considerably reduced.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

AUTUMN rains on a warm soil will stimulate the growth of seedling crops sown recently: thinning will require prompt attention, and advantage must be taken during dry intervals to destroy seedling weeds before rough leaves are formed. By this means the land is kept clean and all work is greatly facilitated. A small side dressing of sulphate of ammonia along the rows of seedling crops after thinning will stimulate growth where it may be desirable. In dry localities young crops of savoy cabbage, cauliflower, &c., that are attacked by the caterpillars of white butterfly and diamond-back moth should be sprayed with a solution of arsenate-of-lead powder 1 oz. to 4 gallons (1½ lb. to 100 gallons), or dusted with a powder composed of one part arsenate-of-lead powder to five parts of hydrated lime, thoroughly mixed by placing them in a closed container and shaking. Applications are best made during the morning or evening, or on dull days when the foliage is damp and cool. Where aphides become established in the heart-bud of these plants serious damage may be done. This is best avoided by an early application of tobacco dust, or a 3-per-cent. nicotine dust, which may be made by placing 1 lb. hydrated lime in a vessel and adding 1 oz. nicotine sulphate, then closing the vessel tightly and rotating it for ten minutes: if a few pebbles are added to the ingredients, before closing the vessel, mixing will be greatly assisted. If the dust is not used at once it may be kept in an airtight vessel, but should not be held for more than one or two months.

With a view to planting out on a warm well-drained piece of land during the month of April a crop of cabbage for cutting in early spring, a seed-bed should be sown during the month of February—towards the end will often be most suitable in the warmer districts.

So soon as crops are cleared the land should be replanted; in the absence of other crops a green cover-crop should be sown. In the case of the tomato crop under glass the house should be sealed so soon as harvesting is finished, and the interior with its contents sterilized by burning screened agricultural sulphur during a windless evening. The sulphur should be used at a rate of 2 lb. per 1,000 cubic feet of air-space and placed in a number of heaps on the floor of the house so as to get a good diffusion of the gas. The next day after airing the house the plants should be cut off a few inches above the surface of the ground, and, when reasonably dry, carried out, with the strings on which they were trained, and burnt. The house then should be swept clean of dust and webs, and the roots lifted, carefully examined, and burnt. The knowledge thus obtained, together with the experience gained during the growth of the crop, gives one useful information about the diseases present and the condition of the soil—data upon which further treatment may be decided. As decay, drips, and cracks in the house seriously affect the health of crops, all repairs should be done efficiently now, especially painting, glazing, and attention to storm-water drainage. Where crops of this class are grown drainage is most important, and there are not a few houses which could be greatly improved and cropping increased by the installation of a thorough system of drainage, especially in localities where there is a heavy subsoil, or a high water-table, or a heavy rainfall. Where sterilization or change of soil is not desired the land can be cultivated lightly and sown down in a green cover-crop to be trenched in later. A thoroughly clean house and a good knowledge of the soil condition are the main factors in the economic production of the following crop.

For some years the principal losses in tomato crops have been due to virus disease of one kind or another, which, owing to the difficulty of early diagnosis, has been spread through the crop by the grower when pruning and by sucking insects. Its consistent appearance in crops from year to year, even when every care has been taken, led to the surmise that it was seed-borne. This opinion seems now to be established as a fact. A recent journal from England states: "Extensive research carried out at the Cheshunt Experimental Station has convinced the scientists that virus diseases are carried in the seed, so that the obvious method of reducing mosaic disease is to obtain seed as free from the virus as can reasonably be guaranteed." Clean seeds are grown best under glass, with all facilities for insect-pest control, or in a cold district where such insects as aphides and thrips are less troublesome. There is also the necessity of growing not only clean seeds, but seeds of good strain. Any one who goes to this trouble and can guarantee a large measure of success in these respects should find a good demand for the seeds. A grower saving seed from his own crop should be careful not only to see that they are saved from fruit of a good type but also that the fruit was borne on a plant that was sound and of good constitution.

Small and Sundry Fruits.

When the strawberry crop is harvested the beds should be cleaned up and given a dressing of bonedust and decayed farm manure, or fowl manure, or blood and bone, thus making best use of the autumn growing-period to build up the constitution of the plants in readiness for another cropping-season. If the beds have run out and are to be cleared it should be done at once and the land planted in broccoli or other winter crops, or sown down in cover-crop for ploughing under.

As the foliage of raspberries and loganberries is rather uncertain in its resistance to chemical sprays, summer pruning should be done promptly after the harvest has been completed, as by doing so a large measure of disease control is secured. Canes and vines are cut off close to the surface of the ground and carried out and burnt. The latter part of the operation is important; it is not sufficient to stack them in a plantation or pile them in a gully to decay, as such practices are fertile means of propagating disease. After training in the new canes and vines a dressing of bonedust or other fertilizer and sowing down in a green cover-crop is often suitable treatment, especially where well decayed farm or stable manure is scarce.

It is often an advantage now to cut out water-shoots completely in gooseberries and the old wood in black currants for the benefit of the new bearing-wood. Eight or ten years is about the profitable life of these crops; but with attention and under good conditions they will remain in profit much longer. However, so soon as vigour begins to wane new plantations should be made.

Where new plantations of strawberries or bush fruits are to be planted, the preparation of the land should be completed so soon as it is cleared of other crops; the eradication of all bad weeds is of special importance. In most cases it is best to plant strawberries as soon as the plants are available, and other bush fruits in early winter. The plants should be ordered now after careful examination to ensure clean, healthy stock, for delivery as soon as they are ready for lifting.

The Homestead Garden.

In the November number of the *Journal* the subject of planning new gardens and alterations or additions to old ones was dealt with. The time has now arrived to carry out such plans of this kind that have been decided upon. If the garden is fairly large it is advisable to submit the plans to some one who has had a wide experience with this kind of work. The common desire to carry out the work oneself is readily appreciated; the planning, too, should be an expression of the owner's tastes and ideals, but owing to a lack of experience with this kind of work one or two rather crude details are apt to creep in and be overlooked until it is somewhat expensive to alter them. Small gardens are a much easier problem, and with them this risk is not so great.

With a good supply of stout pegs and a chain tape the main points of the plan should be located on the ground and marked by driving a peg firmly at each point so that the peg is not easily displaced. The portions to be sown down in grass or planted are then thoroughly cultivated and cleaned in preparation. This is the heavier and most important part of the work and is apt to be hurried, but the best results are obtained only when it is conscientiously carried out, especially in hilly or broken country. Important points are to see that the black soil is kept on top, and there is at least a depth of 6 in. of it in any portion of the lawns and rather more in the borders. Trouble with lawns is very commonly due to a neglect of this precaution. Important also is the grading of the surface of lawns and borders. Where the subsoil is open and well drained, level surfaces may have some advantage, and for some games, such as tennis and croquet, they are necessary; but usually a slight fall away from the buildings is desirable. Steep grades are best avoided so far as possible, owing to the danger of scouring in wet weather until trees and shrubs are well established, or the labour of mowing when they are sown down in grass. A smooth even-graded surface at a suitable height is evidence of good workmanship. At this stage it is best to allow time for the land to consolidate, after which the portions to be sown down in grass should be worked up into a fine seed-bed, the surface trued and firmed by rolling, the grass-seeds evenly broadcasted in calm weather and well raked in. During the period in which the land is allowed to rest and consolidate all seedling weeds should be destroyed by shallow hoeing and a dressing of fertilizers worked in. In many instances a mixture of equal parts of superphosphate and sulphate of ammonia at a rate of 1 oz. to the square yard is most suitable. Grass-seeds used for this purpose vary somewhat according to the soil and climate of the locality; those supplied by a good local seedsman are usually quite satisfactory. The sowing is best made at a rate of 1 oz. of grass-seed to the square yard. This is much heavier than that for farm pastures, but is necessary where fine grasses closely mown are required to make a good turf quickly.

The roads, walks, and service yard should then be graded, formed, and metalled. The grading here is most important, not only to give good appearance but to carry away surface water effectively and promptly and maintain the road in good repair at low cost; not to mention the convenience of clean, dry access at all times. Sometimes it is necessary to go to some trouble to put in culverts or to provide sumps to carry away the water underground; it is then a good investment and will materially contribute to the comfort and appearance of the home.

—*W. C. Hyde, Horticulturist, Wellington.*

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WEATHER RECORDS: DECEMBER, 1936.

Dominion Meteorological Office.

NOTES FOR DECEMBER.

DURING the first half of December the weather was, for the most part, fair to fine over the Dominion, with little rain, and in most of the North Island these conditions continued throughout the third week. Over the North Island during this period dry westerly or south-westerly winds predominated. Southland and parts of Otago also experienced, on the whole, dry and sunny weather. In the remainder of the South Island, however, it was more cloudy and humid. The last week to ten days was everywhere very wet. In the first part of the month much hay was gathered, particularly in the North Island, and shearing was well advanced. Towards the latter end both shearing and work on the land were held up, and in the North some cut hay was lost. There is abundance of pasture everywhere, in many places, indeed, a superfluity. Stock are reported to be in very good condition, but the feed is rather soft, and in some places lambs are not fattening well. The milk-yield has been well maintained Wheat crops, till the end of the month, were in good condition, but fruit crops generally only fair.

Rainfall.—In spite of the fact that the weather was fine during the greater part of the month, the total rainfall was much above normal over the North Island. Many places in eastern and northern districts had more than double the average In the South Island conditions were variable, and departures from normal not usually very large. The West Coast and the high country generally had less, while most of the areas with low average falls had slightly more than normal.

Temperatures.—Temperatures were almost everywhere below normal, though the departures were not, in general, large.

Sunshine—Sunshine was above normal in North Auckland, Tauranga having 253·9 hours, and also in Southland, where Invercargill had 202·8 hours. From North Canterbury to South Auckland it was much below.

Pressure Systems—At the beginning of the month a depression was passing away eastwards, and the weather became fine as an anticyclone moved on to the Dominion. From the 5th to the 7th several rather shallow westerly depressions crossed the South Island, causing a certain amount of rain, but eastern districts and the North Island were very little affected. From the 8th to the 15th there was little storm activity, anticyclonic conditions prevailing for most of the time over New Zealand. On the 16th a deeper depression appeared west of the South Island, and after it had passed eastward was followed on the 17th and 18th by cold southerly gales. Fairly general rain was produced by this storm, but over most of the North Island it was only light.

The first very general rain occurred on the 22nd, when the centre of a depression crossed the southern portion of the South Island Following it, a trough of low pressure moved northwards over the Dominion, strong westerly winds prevailing to the north of it and south-easterlies to the south. The weather remained unsettled until the 24th. There were heavy falls on the 22nd from the Wellington Province southwards, while in the far South the 21st was also very wet.

Unsettled conditions developed again on the 27th, and continued until the end of the month. North-easterly gales were experienced from the Bay of Plenty northward. Except in the western and southern areas of the South Island, heavy rain was general. This was especially the case in the Auckland Province, where considerable flooding occurred, particularly in North Auckland. Much of the North Island received more than the average month's rainfall in the last three days. Warm and sultry weather prevailed in most places throughout this period.

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1936, AT REPRESENTATIVE STATIONS.

—	December, 1936.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall.	Average Rainfall.
			North Island.			
	Inches.		Inches	Inches.	Inches.	Inches.
Kaitaia	4·95	10	2·10	2·63	61·89	54·31
Russell	9·27	5	7·45	2·55	101·57	49·94
Whangarei	7·31	13	4·17	2·99	75·85	60·51
Auckland	3·30	9	1·37	3·18	52·21	49·35
Hamilton	4·09	11	1·06	3·50	54·67	49·54
Rotorua	5·86	11	1·55	3·65	67·53	54·98
Kawhia	4·02	6	1·20	3·30	59·89	53·72
New Plymouth ..	4·46	12	1·09	4·21	62·97	59·70
Riversdale, Inglewood ..	10·35	11	1·93	7·48	104·00	104·17
Whangamomona ..	2·38	7	0·74	5·63	67·20	77·55
Hawera	..	..	..	3·25	..	45·21
Tairua	12·35	6	4·58	4·37	69·22	64·44
Tauranga	9·45	9	4·76	3·47	63·59	52·28
Maraehako Station, Opotiki	8·00	13	2·88	2·92	73·85	53·37
Gisborne	3·45	11	1·15	2·30	44·86	45·13
Taupo	3·41	8	0 89	3·12	50·14	43·87
Napier	3·75	12	0·92	1·94	48·59	30·08
Hastings	2·81	12	1·05	1·88	40·92	31·86
Whakarara Station ..	5·51	13	0·56	..	57·32	..
Taihape	2·73	11	0·80	3·26	44·37	36·72
Masterton	2·55	12	0·69	2·77	47·06	38·24
Patea	5·21	12	2·64	3·52	50·92	44·81
Wanganui	3·42	10	1·50	2·69	39·47	36·11
Foxton	3·58	10	1·25	2·64	40·91	32·51
Wellington	4·43	13	1·26	2·93	56·80	42·30
			South Island.			
Westport	7·23	16	1·65	8·45	88·68	96·80
Greymouth	10·11	18	2·10	8·65	96·60	101·55
Hokitika	9·39	15	2·97	10·37	109·93	114·94
Ross	11·30	12	3·74	12·05	134·76	135·49
Arthurs Pass	9·20	13	..	14·11	143·78	161·91
Okuru, South Westland	5·78	4	3·15	10·97	155·78	144·47
Collingwood	7·24	11	1·45	7·97	97·17	97·40
Nelson	3·00	12	1·07	2·96	43·47	37·82
Spring Creek, Blenheim	2·01	9	0·65	2·10	36·07	30·28
Seddon	1·98	7	0·71	1·96	28·89	24·80
Hanmer Springs ..	3·19	13	1·06	3·80	59·94	45·09
Highfield, Waiau ..	1·83	11	0·72	2·64	42·03	33·28
Gore Bay	2·85	12	1·04	2·57	36·93	31·27
Christchurch	2·64	12	0·65	2·46	36·14	25·13
Timaru	2·77	10	1·11	2·42	30·70	22·68
Lambrook Station, Fairlie	2·75	9	1·16	2·57	30·03	24·87
Benmore Station, Clearburn	1·55	7	0·78	2·34	27·50	24·64
Oamaru	2·01	11	0·49	2·25	24·58	22·01
Queenstown	0·97	8	0·48	2·51	35·37	30·50
Clyde	1·40	9	0·52	1·76	14·66	15·22
Dunedin .. .	5·78	16	1·68	3·47	48·06	36·65
Wendon	3·73	9	1·66	2·82	33·16	29·96
Balclutha	5·07	13	1·93	2·56	38·14	25·62
Invercargill	4·99	19	1·44	4·00	49·58	45·65
Puysegur Point ..	6·78	15	2·05	7·17	111·21	85·26
Half-moon Bay ..	3·47	16	0·97	4·90	62·30	58·79

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VACCINATION OF EWES AGAINST "PULPY KIDNEY" (INFECTIOUS ENTEROTOXAEMIA) IN LAMBS.

FURTHER TRIALS IN OTAGO AND SOUTHLAND, SEASON 1936.

C. V. DAYUS, District Superintendent, Department of Agriculture, Dunedin.

IN the May, 1936, issue of the *N Z Journal of Agriculture*, a summary of the results of the experimental work carried out in Central Otago in the 1935 season was given. This consisted in the vaccination of ewes with a formalized enterotoxaemia (clostridium Welchii, Type D) vaccine, with the object of transferring antitoxic immunity from the ewe to the lamb.

Reference to this article will show that the results obtained justified the trials, and there appeared to be encouraging support to the possibility of the successful vaccination of ewes under practical conditions in the field as a means of minimizing the losses from "pulpy kidney" in lambs.

These field results were further supported by work which had been undertaken in Australia, the results of which were published by D. T. Oxer in the April, 1936, issue of the *Australian Veterinary Journal*. It was clearly demonstrated, by careful laboratory technique, that the usual prophylactic vaccination of ewes against enterotoxæmia is followed in most cases by a marked response, as judged by the antitoxic titre of the blood serum, but it was found that there is considerable variation in the response of different individuals. Also, that the antitoxic immunity developed by the ewe is transmitted to the lamb via the colostrum (first milk).

Oxer concludes, "We are unable to say what degree of immunity would have to be acquired by the lamb before it was protected from the natural infection. It appears probable, however, that a large percentage of lambs would be protected during the first three weeks of life, although it is realized that this can only be determined satisfactorily by extensive trials in the field."

Herein are recorded the results of further vaccination trials which have been carried out in the field in various parts of Otago and Southland during the 1936 season.

In all, 2,608 ewes were vaccinated with a vaccine prepared at the Department's Veterinary Laboratory, Wallaceville. In addition, observations were maintained on a group of 1,141 ewes which were vaccinated by farmers, in some cases with our help, with a commercial enterotoxæmia vaccine purchased from the Commonwealth Serum Laboratories, Royal Park, Victoria.

In the former case the first dose of vaccine (5 c.c.) was given approximately six weeks before lambing and the second dose (10 c.c.) approximately ten days before lambing.

In the latter case the dose recommended for the first vaccination was 3 c.c., followed by a second dose of 7 c.c. four weeks later. Owing to the fact that the vaccine was not procured in time the four-week interval was not strictly followed, and probably insufficient time elapsed between the second dose and the commencement of lambing.

In all cases a suitable number of control ewes were reserved, which, with the vaccinated ewes, were depastured together. The particulars are given in the following tables :—

Table I.—Vaccine prepared at the Veterinary Laboratory, Wallaceville. (First dose, 5 cc., second dose, 10 c c)

District and Farm.	Ewes vaccinated.	Ewes (Control).	Date of First Vaccination.	Date of Second Vaccination.
Ranfurly—				
A	326	325	27/8/36	19/9/36
B	175	175	27/8/36	17/9/36
C	150	150	24/8/36	15/9/36
D	101	100	28/8/36	17/9/36
E	274	226	25/8/36	16/9/36
F	620	650	26/8/36	18/9/36
G	217	217	25/8/36	16/9/36
Middlemarch—				
H	158	105	3/8/36	21/8/36
I	156	122	3/8/36	21/8/36
Otautau—				
J	215	215	30/7/36	22/8/36
Mossburn—				
K	107	106	4/8/36	15/9/36
L	109	109	4/8/36	15/9/36
Totals ..	2,608	2,500	..	..

Table II.—The Losses from Pulpy Kidney up to 30th November, 1936, by which Date Mortality had ceased generally, are shown.

Farm.	Vaccinated Group.	Lamb Deaths from Pulpy Kidney.	Control Group.	Lamb Deaths from Pulpy Kidney.	Remarks.
A ..	326	2	325	9	Total losses from pulpy kidney on farm 11 out of 1,150 ewes.
B ..	175	1	175	7	Total losses from pulpy kidney on farm 17 out of 650 ewes.
C ..	150	0	150	1	Total losses from pulpy kidney on farm 22 out of 1,030 ewes.
D ..	101	2	100	2	Total losses from pulpy kidney on farm 18 out of 740 ewes.
E ..	274	0	226	0	Total losses from pulpy kidney on farm 13 out of 690 ewes.

Table II—continued.

Farm.	Vaccinated Group.	Lamb Deaths from Pulpy Kidney.	Control Group.	Lamb Deaths from Pulpy Kidney.	Remarks.
F ..	620	2	650	29	Total losses from pulpy kidney on farm 36 out of 1,500 ewes. One wether lamb in vaccinated group included, dead day after marking, doubtful if pulpy kidney
G ..	217	0	217	4	Total losses from pulpy kidney on farm 20 out of 1,260 ewes.
H ..	158	0	105	17	Losses in previous years stated to be in the vicinity of 10 per cent. Lambing percentage this year 127 per cent, and total loss on farm from pulpy kidney 45 to 50 lambs
I ..	156	1	122	8	Total losses from pulpy kidney this year 18. Last year, lost 75 lambs, was worst season experienced Owner says up to this season average 10-per-cent. loss
J ..	215	0	215	0	Position unusual, losses generally exceed 5 per cent One lamb was lost from control group, but doubtful if pulpy kidney.
K ..	107	0	106	3	Death-rate from pulpy kidney in past years, 4 per cent. to 10 per cent
L ..	100	0	109	4	Seven lambs actually died here, but owing to the ewes leaving the dead lambs it was only possible to identify four lambs which were definitely from control ewes. Usual death-rate is from 2 per cent to 3 per cent.
Totals	2,608	8	2,500	84	

In the vaccinated group of ewes the pulpy kidney losses among lambs were 8 = 0·306 per cent. In the control group of ewes the pulpy kidney losses among lambs were 84 = 3·36 per cent.

Table III.—Vaccine obtained by the Farmers from the Commonwealth Serum Laboratories, Melbourne. (First dose, 3 c.c.; second dose, 7 c.c.)

Farm.	Ewes vaccinated.	Ewes (Control).	Date of First Vaccination.	Date of Second Vaccination.
M	377	1,473	17/8/36	2/9/36
N	182	182	18/8/36	10/9/36
O	186	186	18/8/36	10/9/36
P	396	434	Group 1 15/8/36 Group 2 28/8/36	12/9/36 23/9/36
Totals ..	1,141	2,275	..	..

Table IV.—The Losses from Pulpy Kidney up to 30th November, 1936, in Lambs from Ewes in Table III

Farm.	Vaccinated Group.	Lamb Deaths from Pulpy Kidney.	Control Group.	Lamb Deaths from Pulpy Kidney.	Remarks.
M ..	377	5	1,473	69	Owing to being unable to procure the vaccine in time the ewes were vaccinated closer to lambing than desirable.
N ..	182	1	182	4	Previous losses on farm about 5 per cent
O ..	186	3	186	4	Previous losses on farm about 5 per cent
P ..	396	13	434	7	The vaccinated ewes were four and five years old, whereas the majority of the controls were two-tooths.
Totals	1,141	22	2,275	84	

In the vaccinated group of ewes the pulpy kidney losses among lambs were 22 = 1·92 per cent.

In the control group of ewes the pulpy kidney losses among lamb were 84 = 3·68 per cent.

TECHNIQUE OF VACCINATION.

The most suitable place to handle the ewes for vaccination is in a drafting-race, into which the ewes are run, filling the race without unnecessarily crushing the sheep. Vaccination is then commenced, and the operator and his assistant work along the whole race, leaning over from outside the race.

The site of injection found suitable is behind the shoulder; this allows the minimum of handling, the ewes standing on all four limbs practically unrestrained. The wool behind the shoulder and the site of injection is thus exposed for the operator; this is quickly cleansed with a swab of cotton-wool soaked in methylated spirit. A 20 c.c. Record hypodermic syringe is used for the injection, and the needle is inserted obliquely, keeping the barrel of the syringe more or less parallel to the body of the ewe, through the skin and the subcutaneous fascia, then the required dose is introduced subcutaneously by pressure on the plunger of the syringe.

At the commencement of the work the syringe is sterilized by boiling. It is important to remove the plunger from the barrel of the syringe. The portions are then placed in the cold water, which is brought to the boil and retained so for ten minutes. The needles are kept handy in a suitable vessel containing methylated spirit.

The vaccine is kept in its original container, the cork being removed and a piece of sterlized rubber tied over the opening; through this the needle of the syringe is inserted to draw off the vaccine. The surface of this rubber top can be kept clean by wiping with a cotton-wool swab soaked in methylated spirit prior to each refill. By this procedure the vaccine is maintained free of extraneous contamination during the course of the operation.

After completing the number of sheep in the race, the syringe and needle are rinsed out with two charges of methylated spirit; in the meantime the next lot of ewes are being driven into the race.

FIG 1.—FILLING THE RACE PREPARATORY TO VACCINATION.

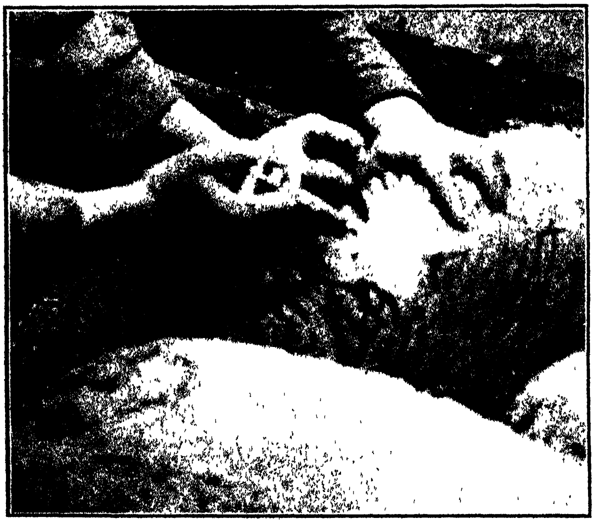

FIG. 2.—THE SITE OF INJECTION EXPOSED, SHOWING THE ANGLE OF THE SYRINGE WHEN INTRODUCING THE NEEDLE.

The vaccine in the container should be used up in one day so as to avoid any quantity being held over for use once the container has been opened. The vaccine in the unopened containers should be stored in a cool dark place until required for use.

Under the conditions outlined no untoward happening has followed vaccination, nor has any harmful result followed the handling of ewes in this manner comparatively close up to lambing.

Another method has been described in Australia, where vaccination has been done inside the thigh or alternatively inside the arm ; either seems unnecessarily laborious, as the sheep have to be handled individually and held up in a sitting position on the rump—an undesirable procedure in the case of ewes advanced in pregnancy.

CONCLUSION.

The results of the trials carried out in the 1936 season lend further support to the possibility of reducing the mortality in lambs from pulpy kidney by vaccination of the pregnant ewe. The percentage loss in the vaccinated group in 1935 was 0·24 per cent., as against 0·306 per cent. in 1936.

The percentage loss in the control group in 1935 was 7·02 per cent., as against 3·36 per cent. in 1936.

There is a slight increase in the vaccinated group of only 0·066 per cent. ; the variation in the response of different individuals to vaccination may possibly account for this. The losses in the control group are considerably down ; this is in keeping with the general position in the district. Losses from pulpy kidney were rather widespread during the susceptible period, but the aggregate losses were as a rule appreciably below the average. This seasonal variation in incidence is a well-recorded factor.

In as many cases as possible the diagnosis in regard to the death of the lamb has been verified, but admittedly in the field a fractional margin of error has to be allowed in this respect, as it is obviously impossible to verify the cause of death in every instance.

It appears that the dose of the vaccine prepared by the Commonwealth Serum Laboratories could be increased with advantage at each vaccination.

Colostrum and blood samples have been taken from vaccinated and control ewes. Blood samples have been taken from lambs of each group at varying intervals. These were forwarded to Wallaceville Laboratory for immunization tests. The results of this work will be published at a later date.

ACKNOWLEDGMENTS.

The vaccine used in the departmental experiments was prepared at the Veterinary Laboratory, Wallaceville, under Dr. Hopkirk. The vaccination work was largely done by A. L. Thompson, M.R.C.V.S., H. Doyle, M.R.C.V.S., and J. Danskin, M.R.C.V.S.

Field arrangements were made and observations kept by Messrs. J. Fleming, A. Douglas, and H. Rountree, Inspectors of Stock at Ranfurly, Lumsden, and Otautau.

Thanks are again due to those farmers in Otago and Southland who willingly co-operated with us.

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APPLICATION OF ORCHARD SPRAYS.

III. SPRAY NOZZLES—*continued.*

G. G. TAYLOR, Plant Disease Division, Plant Research Bureau, Palmerston North.

DEPTH OF PENETRATION.

DEPTH of penetration refers to the distance to which spray is driven from the nozzles and serves to indicate the suitability of any nozzle for driving spray to the highest parts of trees and forcing it amongst the foliage, into bark crevices, bud-scales, &c.

In order to eliminate the influence of wind when making comparisons between different nozzles it was found necessary to take measurements under windless conditions, the maximum vertical height to which spray was driven being taken as an index of penetration. Thus measurements given in the following pages only indicate relative depths of penetration and cannot be taken as the actual distances to which spray would be driven under normal working-conditions.

EXPERIMENTAL METHOD.

A pole, marked in feet and 25 ft. in length, was erected in a perpendicular position. Close to the base of the pole the nozzles were fixed so that they pointed vertically upwards. Measurements of penetration were taken from the maximum height to which spray was actually driven, any drift in excess of this height being ignored. Owing to variations caused by slight air-movements, tests were repeated on two or three different days and the average measurements taken.

Nozzle-pressures were measured and adjusted, and the construction of different nozzle parts varied, by methods identical with those previously described for testing distribution and fineness of spray droplets (see this *Journal*, Vol. 53, p. 68).

RESULTS.

Pressure.—Increase in pressure from 50 lb. to 300 lb. caused a marked increase in depth of penetration (Fig. 18). The rate of increase was greatest as pressures were increased from 50 lb. to approximately 100 lb.

Increase in penetration with increasing pressure was highest where disks having the greatest diameter of apertures were used (Fig. 18).

Disk Aperture.—The depth of penetration increased as the diameters of the disk apertures were increased from $\frac{4}{64}$ in. to $\frac{6}{64}$ in. and $\frac{8}{64}$ in. The rate of increase with increasing diameter of disk aperture was highest where whorl-plates with the greatest diameter openings were used (Fig. 19).

Thickness of Disk.—Increase in disk-thickness from $\frac{2}{64}$ in. to $\frac{4}{64}$ in. caused a slight increase in penetration. Further increase in thickness to $\frac{6}{64}$ in. had no measurable effect.

Depth and Shape of Whorl-chamber.—Increasing the depth of the whorl-chamber from approximately 0·08 in. to 0·24 in. caused only a slight increase in penetration.

Alteration in the shape of the whorl-chamber by means of a ¼-in.-diameter pin projecting 0·04 in. from the centre of the whorl-plate did not cause any appreciable variation in penetration. With the pin projecting 0·08 in. penetration appeared to be slightly reduced.

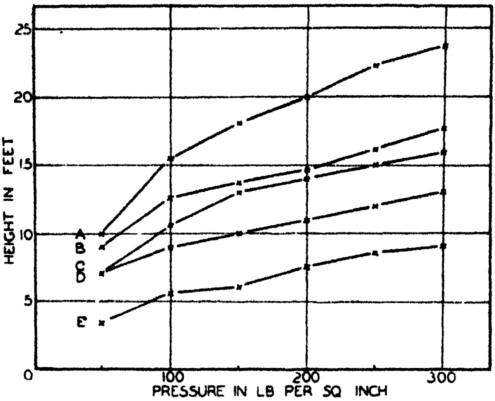


FIG. 18. EFFECT OF INCREASE IN PRESSURE ON THE MAXIMUM HEIGHT OF CARRY UNDER WINDLESS CONDITIONS.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows :—

Curve A : Whorl-plate with six openings of diameter $\frac{12}{64}$ in. at angle of 22·5° ; disk aperture $\frac{8}{64}$ in. diameter

Curve B. Whorl-plate with six openings of diameter $\frac{12}{64}$ in. at angle of 22·5° ; disk aperture $\frac{4}{64}$ in. diameter.

Curve C : Whorl-plate with six openings of diameter $\frac{4}{64}$ in. at angle of 22·5°, disk aperture $\frac{8}{64}$ in diameter.

Curve D · Whorl-plate with six openings of diameter $\frac{4}{64}$ in. at angle of 22·5° ; disk aperture $\frac{4}{64}$ in diameter.

Curve E : Whorl-plate with two openings of diameter $\frac{4}{64}$ in at angle of 67·5° ; disk aperture $\frac{8}{64}$ in. diameter.

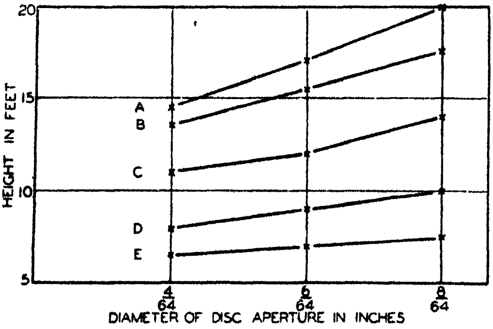


FIG. 19. EFFECT OF INCREASE IN THE DIAMETER OF DISK APERTURE ON THE MAXIMUM HEIGHT OF CARRY UNDER WINDLESS CONDITIONS WITH A NOZZLE PRESSURE OF APPROXIMATELY 200 LB.

The different curves show the effects produced when using whorl-plates of varying construction, as follows :—

Curve A : Whorl-plate with six openings of diameter $\frac{12}{64}$ in. at angle of 22·5°.

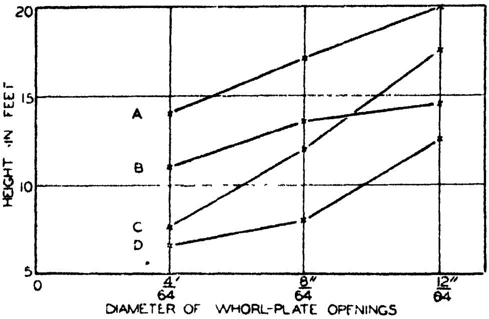
Curve B : Whorl-plate with six openings of diameter $\frac{8}{64}$ in. at angle of 22·5°.

Curve C : Whorl-plate with six openings of diameter $\frac{4}{64}$ in. at angle of 22·5°.

Curve D : Whorl-plate with two openings of diameter $\frac{8}{64}$ in. at angle of 67·5°.

Curve E : Whorl-plate with two openings of diameter $\frac{4}{64}$ in. at angle of 67·5°.

Diameter of Whorl-plate Openings.—Penetration was increased when the diameter of the whorl-plate openings was increased from $\frac{4}{64}$ in. to $\frac{8}{64}$ in. to $\frac{12}{64}$ in. This effect was most marked where disks having the greatest diameter apertures were used (Fig. 20).



G. 20. EFFECT OF INCREASE IN THE DIAMETER OF WHORL-PLATE OPENINGS ON THE MAXIMUM HEIGHT OF CARRY UNDER WINDLESS CONDITIONS WITH A NOZZLE PRESSURE OF APPROXIMATELY 200 LB.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows

Curve A Whorl-plate with six openings at angle of 22·5°, disk aperture $\frac{8}{64}$ in diameter.

Curve B: Whorl plate with six openings at angle of 22·5°; disk aperture $\frac{4}{64}$ in diameter.

Curve C Whorl-plate with two openings at angle of 67·5°; disk aperture $\frac{8}{64}$ in. diameter.

Curve D · Whorl plate with two openings at angle of 67·5°; disk aperture $\frac{4}{64}$ in. diameter

Angle of Whorl-plate Openings.—Increase in the angle of the whorl-plate openings from 22·5° to 45° and 67·5° decreased penetration in those cases where whorl-plates with apertures $\frac{4}{64}$ in and $\frac{8}{64}$ in. diameter were used. With whorl-plate apertures of $\frac{12}{64}$ in. diameter the effect of increase in the angle of the openings on the depth of penetration was not significant (Fig. 21).

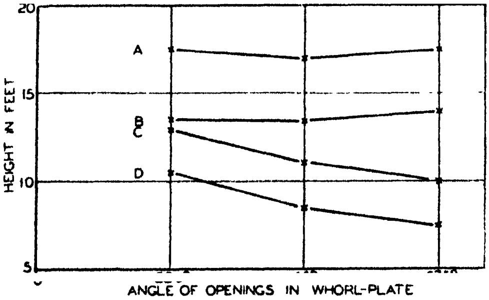


FIG. 21. EFFECT OF INCREASE IN THE ANGLE OF WHORL-PLATE OPENINGS ON THE MAXIMUM HEIGHT OF CARRY UNDER WINDLESS CONDITIONS WITH A NOZZLE PRESSURE OF APPROXIMATELY 200 LB.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows:—

Curve A: Whorl-plate with two openings of diameter $\frac{12}{64}$ in.; disk aperture $\frac{8}{64}$ in. diameter.

Curve B: Whorl-plate with four openings of diameter $\frac{12}{64}$ in.; disk aperture $\frac{4}{64}$ in. diameter.

Curve C: Whorl-plate with two openings of diameter $\frac{8}{64}$ in.; disk aperture $\frac{8}{64}$ in. diameter.

Curve D: Whorl-plate with two openings of diameter $\frac{4}{64}$ in.; disk aperture $\frac{8}{64}$ in. diameter.

Number of Whorl-plate Openings.—The depth of penetration was increased by increase in the number of whorl-plate openings from two to four and six (Fig. 22).

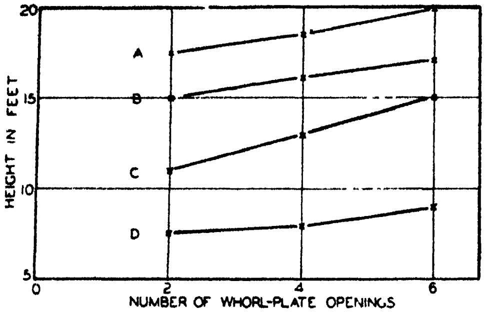


FIG 22. EFFECT OF INCREASE IN THE NUMBER OF WHORL-PLATE OPENINGS ON THE MAXIMUM HEIGHT OF CARRY UNDER WINDLESS CONDITIONS WITH A NOZZLE PRESSURE OF APPROXIMATELY 200 LB.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows —

Curve A: Whorl-plate with diameter of openings $\frac{12}{64}$ in. at angle of 22·5°; disk aperture $\frac{8}{64}$ in. diameter.

Curve B Whorl-plate with diameter of openings $\frac{12}{64}$ in. at angle of 45°; disk aperture $\frac{6}{64}$ in. diameter

Curve C. Whorl-plate with diameter of openings $\frac{8}{64}$ in. at angle of 45°; disk aperture $\frac{8}{64}$ in. diameter.

Curve D: Whorl-plate with diameter of openings $\frac{4}{64}$ in. at angle of 45°; disk aperture $\frac{4}{64}$ in. diameter.

Strainer.—The use of a strainer had no measurable effect on the depth of penetration.

GENERAL OBSERVATIONS.

The maximum height of carry was varied considerably by wind, being reduced 50 per cent. by even a light breeze. It was noted that the effect of wind was greatest where nozzles having the poorest penetration were used.

Some of the spray tended to fall before reaching the maximum height, thus only a portion of the total volume of spray delivered by the nozzle had maximum penetration.

(To be continued.)

The production of superphosphates in 1935–36 reached a new record high level (322,522 tons), being 5,542 tons, or 2 per cent., greater than the 1934–35 figure.

Pedigree Grass and Clover Seeds.—With a view to further improving the pastures of the Dominion, the Division early in 1935–36 had harvested some Government pedigree grass and clover seeds. Such seed, which will be produced during each succeeding year, has been grown on contract from seed especially raised at the Plant Research Station at Palmerston North. The production of such seed is considered to mark a further advance in the already high standard of the Dominion's certified seed. Pedigree stock seed is intended for sowing down areas to be devoted to the production of certified pedigree seed. No difficulty whatever was experienced in the disposal at remunerative prices of the 800 bushels of Government pedigree stock perennial rye-grass seed and several hundred pounds of pedigree white-clover seed.—*Annual Report, Director of the Fields Division.*

FARMERS' FIELD COMPETITIONS.

WELLINGTON DISTRICT, SEASON 1935-36.

C. J. HAMBLYN, Fields Superintendent, Palmerston North.

A REVIEW of the farmers' field competitions in the Wellington district for the season 1935-36 discloses a definite trend in the direction of increased interest in competitions connected with pastures. A rise in the number of entries from 912 in the 1934-35 season to a total of 1,318 in the past season is accounted for in the main by a considerable increase in the entries for grass-silage, hay, and pasture competitions. In those districts where competitions have been recently started, fodder crops figure largely in the entries, but as experience in competition work is gained, silage and hay take a more prominent part, and finally pasture competitions, undoubtedly the most valuable of all, are taken up.

The cheapest food produced on the farm comes from the pastures, and it is safe to say that 95 per cent. of the feed produced on the average North Island farm is derived from grass. Further, the quality and value of the grass, hay, and silage depends largely on the quality of the raw material—that is, the pastures. Therefore, competitions designed to assist in improving the pastures of a district tend to increase the quantity and value of the main source of feed, and automatically improve the quality of hay and silage reserves. While North Taranaki is, as yet, the only district where progress has been made in pasture competitions, the success of these competitions, which is due in a large measure to the satisfactory method of judging evolved, has aroused interest in other districts, and a satisfactory extension of these competitions is indicated. There is little doubt that this type of competition will gradually supersede the original fodder-crop competitions.

Another factor which should favour this trend is that, while in districts new to competitions the general average yield of fodder crops is rapidly increased through the lessons learnt from the competitions, there comes a time when further improvement in economical crop production is likely to be gained more effectively by means of experimental and demonstrational work in connection with new varieties of higher feeding-value, economy in the use of artificial fertilizers, &c. A review of varieties grown, fertilizers used, and methods of cultivation in the case of root-crop competitions reveal the fact that, while there has been undoubtedly some selection of proved suitable varieties and more attention paid to cultural methods, there have been few, if any, new varieties tried. There is still a wide divergence in the type and amount of artificial manures used, and no uniformity has been arrived at in regard to spacing either in the rows or between the rows for the various crops.

The organization of the field competitions in North and South Taranaki, Wanganui, Manawatu, Wairarapa, and Hawke's Bay districts has been carried out by the various branches of the Farmers' Union, while in the Poverty Bay district the directorates of the dairy companies have played a prominent part with valuable assistance from the A. and P. Societies. In most districts local competitions are arranged by individual branches of the Farmers' Union, and in many cases several branches have combined in group competitions.

In North Taranaki, in addition to the group or district competitions, a central executive arranges for North Taranaki championships in all classes, and the championship judging in some of the competitions is made the occasion of combined field-days attended by large gatherings of farmers from a widespread area. The same procedure is being developed in South Taranaki, and should extend the interest and value of the competitions.

The following table illustrates the present position with regard to the extent and scope of the competitions in the Wellington District :—

Competition.	North Taranaki.	South Taranaki.	Wanganui.	Manawatu.	Wairarapa.	Hawke's Bay.	Poverty Bay.	Total.
Mangels	15	10	10	34	11	10	28	118
Carrots	39	13	12	6	..	4	..	74
Swedes	53	12	..	16	..	12	..	93
Chou moellier ..	..	5	..	11	12	9	..	37
Mixed roots ..	17	..	..	..	..	..	..	17
Hay	184	59	..	..	..	..	..	243
Silage	281	64	..	17	..	24	42	428
Pasture	308	..	..	..	..	..	..	308
	897	163	22	84	23	59	70	1,318

Compared with the 1934-35 season, while there has been a slight drop in the entries for root crops, from 343 to 339, there has been an increase in entries for hay, from 170 to 243, a greater increase in ensilage, from 274 to 428, and a considerable extension of the North Taranaki pasture competitions, from 107 to 308 entries.

The judging of the competitions was again carried out by the Instructors of the Fields Division of the Department of Agriculture, and certificates of merit were awarded to leading competitors. In most districts interest in the judging was well maintained, and the round of the entries was made by large numbers of farmers, and the occasion made a field-day, when useful discussions on methods and results take place. In a few districts this important feature of competition work has unfortunately not been developed, or has lapsed, and much of the value of the competitions is lost. Another important part of the competitions is the valuable report and criticism prepared by the judges on each competition for local publication and discussion at prize-giving functions.

MANGELS.

The wet summer was not favourable to this crop. Many farmers were unable to keep weeds in check, but even where crops were perfectly clean the yield was considerably lower than in the previous dry season. The heaviest crop in the Wellington District, of 115 tons, was grown by Mr. N. Hughes, of Maxwell. In a special Young Farmers' Club competition in the Gisborne District, there were seventeen entries, the average yield of the crops was 80 tons per acre, and the heaviest crop, of 131 tons, was grown by Mr. R. H. Nelson.

CARROTS.

Carrots were not so much affected by the adverse weather, though the average yield was 7 tons per acre less than for last year. Of seventy-four entries, with an average yield of 43 tons, the best crops were grown by Mr. H. A. Shaw, Eltham, 71 tons 8 cwt. (a splendid crop of Matchless White), and Mr. N. Hughes, Maxwell, 64 tons 13 cwt. of Matchless White and 59 tons 12 cwt. of Guerande. The Guerande was again prominent in regard to number of entries and average yield, while Holmes's Improved was favourably commented on in North Taranaki and Matchless White in the southern portion of the same province.

SWEDES.

In contrast to the lower average yields from mangels and carrots, swede crops were generally good. Ninety-three crops were judged in the various competitions, the best crops being grown by Mr. C. Spence, Apiti, Manawatu, 64 tons per acre, and Mr. A Mullinder, Otawhao, Hawke's Bay, 61 tons 11 cwt. Superlative was again the favourite variety, but two later-maturing varieties, Vilmorin and Wilhelmsburger, gave satisfactory yields, and were particularly free from dry-rot. For this reason these varieties should prove valuable to growers requiring swedes for late-winter and early-spring use Both varieties develop very strong roots, and are not easy to pull

CHOU MOELLIER.

The number of chou moellier crops judged increased from twelve to thirty-seven, and yields were considerably better than in the previous year, the wet conditions favouring this crop It appears that the growing of chou moellier is on the increase, mainly because of its resistance to club-root. Dry-rot was prevalent in some crops, particularly where chou moellier followed a previous crop of swedes or soft turnips. Competitions were again held in South Taranaki and Hawke's Bay, and new competitions for this crop were conducted in the Wairarapa and Manawatu. The best crops were grown by Mr. A. S. D'Ath, Feilding, 44 tons , Mr. T. H. Verry, Konini, Pahiatua, 43 tons 16 cwt. ; and Mr. W. G. Hunt, Otawhao, Hawke's Bay, 42 tons 12 cwt. The best crop the previous season was one of 29 tons.

ENSILAGE.

There was a marked increase in the number of entries judged in the ensilage competitions, from 274 to 428, although in several districts many ensilage stacks and trenches entered were not opened up for judging on account of plentiful winter feed-supplies. In North Taranaki the competition was again divided into five classes, a total of 281 entries being judged, the championship awards being as follows: Stack ensilage-grass (154 entries), R. G. Luxton, Urenui ; stack silage, any other crop (nine entries), H. T. Paul, Okato (oats) ; hillside stack silage (twenty-five entries), W. Summers, Tariki ; earth pit silage (thirty-one entries), J. H. Paulger, Tikorangi ; concrete pit silage (twenty entries), E. C. Locke, Hillsborough.

In South Taranaki there were sixty-four entries comprised of stacks, fifty ; earth pits, twelve ; and concrete pits, two. The winners of the two main classes were—Stack ensilage (grass), Mr. G. Hurley, Whenuakura ; pit silage-grass, Mr. F. J. Mehrtens, Eltham. Entries in the Poverty Bay district increased from fourteen to forty-two ; the Gisborne - East Coast district competition was won by a Maori farmer, Mr. J. B. Dews, Ruatoria ; and the Wairoa competition by Mr. H. S. Findsen.

In Southern Hawke's Bay twenty-four entries from the Takapau and Norsewood districts were judged, the winner being Mr. W. Jenkins, Norsewood.

The Wairarapa ensilage competition was abandoned, as a large proportion of the entries were not being opened up.

In general, while the stack method is still favoured in Taranaki, the trench or pit method, because of the reduction in labour and equipment necessary, is being developed in most other districts, and particularly in Hawke's Bay and Poverty Bay. One of the first results of ensilage competitions is a marked and rapid improvement in the type and uniformity of the silage made. Another good result is the elimination of waste through better stacking and covering. These improvements can be and are made in too many cases without a proportionate improvement in the quality of the silage or in the value of the material for the main purpose for which it is made—that is, milk-production.

Grass silage is used rather indiscriminately for two distinct purposes—first, for milk-production occasionally in dry summers, but mainly in the early spring when grass-supplies are short, and secondly for winter-feeding of dry stock. For milk-production the value of the silage, judged under the heading of quality, would depend on the stage of cutting—that is, the content of fibre—and also on the composition in respect to good grasses and clovers. For winter-feeding of dry cows and young stock a considerably more fibrous and bulky type of silage would appear to be more suited to the requirements of the stock. It seems desirable, therefore, in competitions to define the use to which the silage is to be put and to divide the competitions if necessary into two classes, one for milk-producing silage and another for winter feed. Such a division would probably require judging of the latter in June or July and the former in August or early September. In the case of milk-producing silage, greater attention could then be paid in judging to the stage of cutting, since it is well known that pasture coming into flower is too rank for good milk-production.

HAY.

Haymaking competitions were again confined to the Taranaki Province, where 243 entries were judged, as compared with 170 the previous year. Early-cut crops escaped the broken weather which spoilt the majority of the later crops, and the winners of the various district competitions were amongst those that experienced favourable haymaking conditions. The North Taranaki winners were—for grass hay, J. M. Blyde, Lepperton; oaten hay, E. B. Corbett, Okato. For South Taranaki—grass hay, O. T. Parry, Manaia; and for lucerne hay, T. R. Taylor, Manutahi.

PASTURE COMPETITIONS.

The North Taranaki pasture competitions were considerably extended, a total of 308 pastures being judged, as compared with 107 the previous year. Details of this competition have been published in this *Journal.* As previously mentioned, this type of competition is being arranged for in the South Taranaki, Hawke's Bay, Poverty Bay, and Manawatu districts, and should do much to assist in improved pasture establishment and management, and incidentally improve the quality of raw material in the use of grass-ensilage and meadow-hay competitions.

CONCLUSION.

Great credit is due to the officers of the numerous branches of the Farmers' Union for the active part taken in the organization of the competitions, and also to those dairy companies and agricultural and pastoral associations which have interested themselves in various district competitions. The continued interest in the competitions, as indicated by increasing entries and wider scope of the work, is encouraging to both the organizers and judges.

WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

RECORD OF WORK FOR SEASON 1935-36.

A STUART, Instructor in Agriculture, Invercargill.

THE 1935-36 season was again rather unfavourable for dairying operations, as was exemplified by a slight decrease in production, due to a late spring being followed by dry conditions in the summer months, although this was compensated for to some extent by the grass-growth experienced in the autumn and early winter. This season 5,499 lb. of butterfat were actually sold from the thirty-three cows milked, compared with the 6,959 lb. from thirty-six cows the previous season. Ten calves were reared, and the whole herd was recently tested for tuberculosis, with a negative result from the reaction standpoint.

The ewe flock, consisting of eighty-five ewes, produced 110 lambs, and of these 100 lambs were obtained fat off their mothers. The flock was grazed from lambing till weaning on a paddock of less than 12 acres, and which had been sown in 1931 with certified rye-grass as the basis of the seeds mixture.

In April it was found that the Aberdeen turnips, which had been sown as a second crop following swedes, were unsafe to feed to the dairy herd owing to a severe wet-rot infection following dry-rot. Ninety wethers were purchased to clean up this area, and these were later disposed of when fat at a profit.

CARRYING-CAPACITY TRIAL.

This trial was laid down in the spring of 1933 in field 6 to determine the relative carrying-capacity and production of certified and uncertified rye-grass. One-half of the area was sown with certified rye-grass and the other half with a blend of five uncertified commercial lines of rye-grass. An uncertified white-clover strain was included in both, which were sown with oats as a nurse crop.

During the first autumn the uncertified rye-grass gave the best results, carrying slightly more stock and producing more butterfat, but since that period the certified rye-grass has steadily forged ahead. The table appended below gives the carrying for this season, together with the butterfat produced per acre.

Month.	Certified Rye-grass.		Uncertified Rye-grass.	
	Cow-days per Acre.	Butterfat (Pounds) per Acre.	Cow-days per Acre.	Butterfat (Pounds) per Acre.
September	30·3	17·0	10·0	5·4
October	45·3	27·2	27·9	17·9
November	21·2	13·2	19·3	21·9
December	86·7	91·5	69·3	75·5
January	44·8	37·8	31·2	24·3
February	30·1	20·8	13·2	9·7
March	25·6	16·4	25·6	16·8
April	38·7	22·3	21·6	10·6
May	36·0	18·9	14·4	6·5
June	25·2	4·7	7·2	0·9
July and August ..	Nil	Nil	Nil	Nil
Totals for year ..	383·9	269·8	239·7	189·5
Totals to date since first grazed	722·5	584·6	512·2	442·6

In addition, 21·1 dry-stock-days per acre have been obtained from the certified rye-grass, and 13·6 dry-stock-days per acre from the uncertified rye-grass.

The areas seen at the present time present a more striking difference than is exemplified in the figures given above. The sward of the certified area is a dense mat of vigorous rye-grass and white clover, whereas the sward of the uncertified is very open, consisting mainly of white clover with some rye-grass, and an invasion of brown-top, Yorkshire fog, and Scotch thistle has taken place.

ROOT-CROP INVESTIGATIONS.

Contrary to the experience obtained in the two last seasons, it was found possible to grow, no doubt due to weather conditions, quite fair swedes as a second crop in field 5. Seventy-two varieties were hand-sown on land preridged and fertilized with 2 cwt. per acre of superphosphate applied through the front box plus 2 cwt. of equal parts of superphosphate and carbonate of lime through the rear box. These swedes were examined for club-root and mottled heart, and whereas the percentage of club-root varied from nil to 73·5, mottled heart was 100 per cent. prevalent in thirty-two varieties.

In this field two blocks of Aberdeen turnips were grown, one block consisting of certified Bruce turnip, and the other, seed of Victor Achilles. Both these crops, and in particular the latter, suffered from the ravages of dry-rot, which early in April turned to a wet-rot, and prevented the area being fed to the dairy herd, although before this was known four cows succumbed to bloat after half-an-hour's grazing on the field. Victor Achilles yielded 33 tons per acre, and the Bruce 27 tons per acre. Mottled heart was detected in both crops.

In field 8, which was ploughed out of lea early in the winter, five blocks of swedes were grown with the same manurial treatment as quoted above, except that in addition half of each block received a pre-top-dressing of 10 cwt. per acre of carbonate of lime some time before sowing The five varieties were examined for mottled heart and yielded as follows– the weights on limed and unlimed ground being averaged :—

Variety.	Yield in Tons per Acre.	Percentage of Mottled Heart.
Grandmaster	62·23	95
Ninety-nine	62·15	100
Tipperary	52·92	100
Wilhelmsburger Otofte ..	51·02	90
Peerless	49·40	100

In addition, small-variety trials were conducted in both the above fields in connection with certified seed Kohl rabi was also tried and found to be subject to club-root, and in no degree comparable to chou moellier or kale

GRASS AND CLOVER TRIALS.

The duplicate series of plots laid down in November, 1934, at either end of field 9 were fenced, and subjected to differing forms of management in that, while one was grazed intermittently throughout the year, the other was hayed and the aftermath grazed. The haying and more lenient management has resulted in great stimulation to the Montgomery red clover which was employed in the basic seed mixture, and no doubt further differences will appear after a further period. In both series very little false perennial rye-grass remained in these particular plots after eighteen months. Meadow fescue, where substituted for perennial rye-grass, also failed to withstand competition. All these plots have become clover dominant.

In field 7 the original two hundred rye-grass plots which were established seven years ago still present the marked differences in the density of the rye-grass in the sward, the poorer plots having filled in with brown-top and *Poa annua*.

In field 2 the rye-grass germination trial consisting of 330 lines was harvested early in January, but, unfortunately, owing to the fairly low rainfall conditions experienced in December, no fungus attack developed on the seed, which was all of good germination. This experiment will be repeated this season, and by the law of averages some results should be forthcoming, as the district has already experienced two successive dry seasons with consequent good germination of certified rye-grass seed.

MISCELLANEOUS.

An oat-treatment trial to determine the relative merits of dry-dusting seed with "Ceresan New" or pickling with formalin was carried out during the season in field 2. Results of this trial have already been published in the *Journal of Agriculture,* Vol. 53, August, 1936.

An oat-variety trial was also laid down in field 1, but owing to the loose texture of the soil, coupled with early spring sowing, birds totally destroyed the experiment at an early stage.

The rate-of-liming trial laid down in August, 1933, on grass showed up remarkably during the autumn. The incidence of grass-grub and

Porina attack was most marked on the unlimed ground, steadily decreasing in the 1- and 2-ton-per-acre blocks, and being practically unnoticed on the 4-ton-per-acre block, where both grasses and clovers were the most vigorous and dense.

ACKNOWLEDGMENTS.

The capable manner in which the work on the farm has been performed by the farm-manager, Mr. P. McMillan, warrants favourable mention, and as a result the farm committee under the able chairmanship of Mr. D. H. McLean, Caroline, has been relieved of undue anxiety. Material assistance was again forthcoming from the R. M. McKinnon Trust, in addition to the Government subsidy, and this assistance is greatly appreciated.

In connection with the comprehensive trial to measure the differences in carrying-capacity and production between certified rye-grass and the best local strains employing a ewe flock, and for which arrangements have already been made, the following farmers have donated seed, which is gratefully acknowledged · W. Allison, Drummond ; E. S. Beck, Wairio; J. H. Beck, Woodlaw ; E. A. Cameron, Freshford ; S. Irwin, Browns; R. Kennedy, Bayswater ; D. McDonald, Dipton ; J. C. Paterson, Wendonside , J. Plunkett, South Hillend ; Spratt Bros., Drummond , T. S. Smith, Winton , and M. S. Thomson, Lochiel.

STRAIN IN SUBTERRANEAN CLOVER.

E. BRUCE LEVY and L W GORMAN, Grasslands Division Plant Research Bureau.

SUBTERRANEAN clover (*Trifolium subterraneum*) is an annual which perpetuates itself by copious reseeding. In grassland economy the annual is important, and more particularly so under soil and climatic types that impose on the vegetation periodic and seasonal stresses unfavourable to sustained growth Low soil-fertility that permits of vacant spaces in the sward, or drought that causes growth to cease and swards to open, are the two major contributing factors to the income and persistence of the annual. The common annual clovers in New Zealand grasslands may be arranged in an ecological order ranging from the hardest and poorest of habitats up to habitats where the perennial species are able to dominate. Haresfoot trefoil, striated clover, clustered clover, suckling clover, hop-trefoil, reversed clover, subterranean clover, spotted burr-clover, and toothed burr-clover represents a fairly accurate placing in ascending order according to habitat, the haresfoot trefoil occupying the poorest and hardest habitat and the burr-clover the more fertile The habitat a stage better than the burr-clover habitat may be occupied by perennial species, and the chief of these is white clover. White clover, however, also perpetuates itself on fairly hard habitats by reseeding, and in this regard it is of great ecological interest that the poorer, short-lived, almost annual strains of white clover dominate on the more arable and harder habitats in New Zealand, the more perennial strains occupying the really high-fertility habitats that seldom are subject to hard seasonal conditions. Of the perennial strains of white clover, Kentish wild white appears to offer the best form for perennial low-fertility habitats, the New Zealand type 2 the more suitable for the next grade of soil, and the New Zealand type 1 for the most fertile soils or those that can be rendered so by top-dressing, &c.

This classification of clover types enables one to visualize readily the place subterranean clover may take in grassland ecology The burr-clovers may be ruled out as being unsuitable for pasture work on account of their low palatability and burr-like seed-pods that are a menace to the wool crop Thus subterranean clover occupies a place in grassland ecology intermediate between suckling clover and perennial strains of white clover, merging well with the suckling clover habitats and covering as well the habitat range of the annual and short-lived strain of white clover. A plant in such a position is of great value in any programme of pasture improvement where the initial soil conditions are such that good strains of white clover may not be readily established. Subterranean clover, then, is a pioneer acting in the capacity of a stepping-stone between the less valuable annual clovers and white clover The above arrangement of clovers is a reliable index of the available soil fertility, particularly in regard to available supplies of phosphate, potash, and lime, and just as each represents a fertility standard so each represents a fertility demand. Thus subterranean clover has a soil-fertility demand between suckling and white clover

The rise of a species to dominance in grassland is a reflex of its ability to produce under the conditions offering. Thus, in a rising scale of fertility upbuilding, subterranean clover replaces suckling clover and white clover replaces subterranean clover, provided always in the latter case that droughts do not hinder and retard the development of the perennial white clover.

The ability of subterranean clover to produce more fodder than suckling clover is the keynote to the successful use of phosphatic top-dressing on country that prior to the introduction of subterranean clover scarcely returns sufficient growth to warrant the expense of top-dressing. Haresfoot trefoil, striated clover, clustered clover, and suckling clover all respond to phosphatic top-dressing, but the results from top-dressing these plants have not encouraged the widespread use of phosphate on them. The introduction of subterranean clover on to country carrying swards where the lesser annual clover dominated previously has meant an extended range of country that can be profitably top-dressed, and this fact has led to an enormous increase in the amount of subterranean-clover seed sown during the last two or three years. It must be realized that the value of subterranean clover is largely wrapped up in the knowledge that the country pays to top-dress when subterranean clover is present, and does not pay to top-dress when subterranean clover is absent.

This point alone is of great significance, because the moment phosphate may be economically applied any grassland farmer has the making of his country in his own hands. Phosphate is the driving force to grassland progress, and the more efficiently this

1. PERENNIAL RYE-GRASS, SUBTERRANEAN CLOVER, WHITE CLOVER IN ASSOCIATION ON RIVER-ACCRETION COUNTRY, GIVING A GOOD SWARD WITH THE SUBTERRANEAN CLOVER DOMINATING THE WHITE CLOVER

Such a sward can be profitably top-dressed.

[*Photo by E. Bruce Levy.*

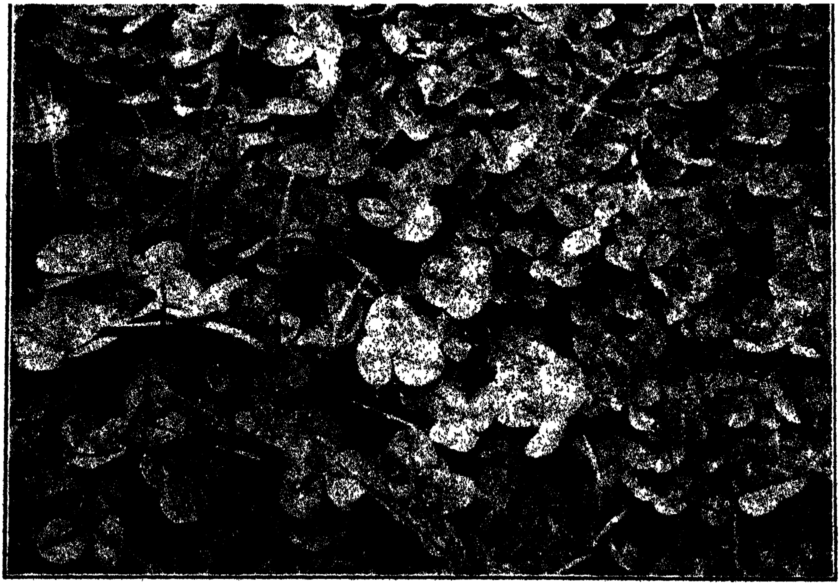


FIG. 2. PERENNIAL RYE-GRASS, WHITE CLOVER, SUBTERRANEAN CLOVER IN ASSOCIATION ON RIVER-ACCRETION COUNTRY.

White clover is dominating the subterranean clover wherever the soil fertility is sufficiently high for good white-clover growth or is being maintained at a high level by the use of superphosphate.

[*Photo by E. Bruce Levy.*

force can be applied the greater the progress. Subterranean clover is a more efficient and larger-capacity machine for the exploitation of phosphate than are the lesser annual clovers, and on this fact lies its intrinsic potential value on all those soil types which in their initial unimproved conditions do not, or cannot be economically made to, support white clover.

The writers in subsequent pages have dealt with the question of strain in subterranean clover, and it will be clear that there are possibilities in regard to the use of various strains. Subterranean clover in itself reflects extremely well the selective propensities of a species to variously conditioned habitats. Thus we have the extremely early, stemmy, free-seeding, short-lived strains that are suitable for the extremely dry habitats where only short periods for growth intervene between periods of drought. The mid-season strains can be regarded as suitable for less droughty conditions, and the late strains suitable for areas where moist conditions prevail well into the season. Ecologically there is no call in New Zealand for the specially early-flowering group, but there is definitely a place for the mid-season- and late-flowering groups. Both these latter groups are desirable—the mid-season to give the autumn, winter, and early spring growth, and the late to continue the spring growth further into the summer. Thus the use of the two strains, either blended together in the one mixture or sown as separate paddocks, tends to extend the seasonal range of production of subterranean clover on the farm.

Subterranean clover generally should not be sown pure, but for preference should be combined with a good perennial strain of white clover and perennial rye-grass.

The reason for this is obvious, viewing the possibilities for improvement and development that are created by phosphating and by increasing the stock carried per acre as a result of the increased feed produced. The subterranean clover initiates the improvement, and the stock carried, in addition to the phosphate applied, carries this improvement forward to a point where the conditions are made suitable for the growth of good strains of white clover and rye-grass, and the moment this eventuates, provided the white clover and the rye-grass are included, the development is carried a stage further, to the point that there develops a rye-grass - white-clover sward with the subterranean clover occupying a smaller and smaller position in the grassland, it going the way of all annuals once the soil conditions are brought to a stage where the high-producing perennial species are adequately provided for.

In the case of developing very low-fertility soils which have to undergo marked change before the rye-grass - white-clover sward is possible, then pure sowings of subterranean clover may be fully justified, but where the soil and climatic conditions are not far removed from the possible rye-grass - white-clover sward, then the three species should be combined.

STRAIN TRIALS.

Altogether fifty-seven different samples of this seed have been grown at this station. Nine were from commercial sources and forty-eight were obtained from Australian research stations. After making general observations for a period of three years, a more intensive study was commenced. This has been in progress for the last two years. Seed of each sample was sown in boxes of sterilized soil on 11th February, 1935. The resulting seedlings were planted out in May as spaced plants 1 ft. apart in plots 10 ft. long by 5 ft. wide, and then allowed to grow and join up to form the equivalent of a broadcast plot. Completed records on these plots over a period of one year were kept, and the following matters were recorded : Nature of growth (leafy or stemmy) ; time of commencing growth (late winter or early spring) ; date of commencing flowering ; date of dying off (summer) ; yield of herbage ; time of re-establishment from shed seed ; autumn growth ; rust infection ; winter growth. When all these matters were taken into consideration it was found that the samples could be classified in four groups. The general characteristics of these groups are as follows :—

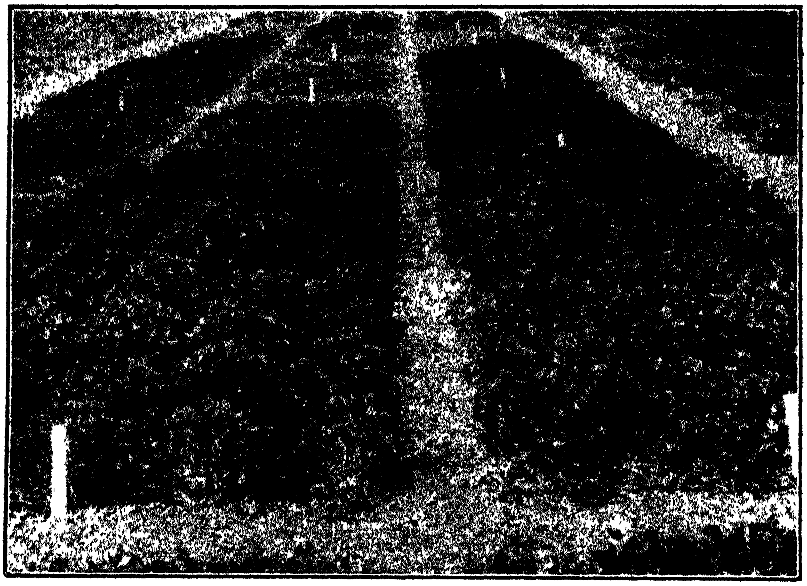


FIG. 3. SUBTERRANEAN-CLOVER STRAIN TRIALS SHOWING SPRING GROWTH AND PARTICULARLY THE GOOD EARLY SPRING GROWTH OF THE BURNERANG AND NANGEELA STRAINS

Photograph taken 16th October, 1935

Foreground (left to right) : (*a*) Burnerang. (*b*) Nangeela.
Second row : (*a*) Mount Barker. (*b*) Mount Barker. (*c*) Tallarook.
Third row : (*a*) Myall. (*b*) Daliak. (*c*) Wenigup.
Fourth row : (*a*) Mount Barker. (*b*) Tallarook. (*c*) Dwalganup.

[*Photo by L. W. Gorman.*

Group 1.—Each strain included in this group has small dark-green-coloured, indistinctly marked leaves. The plants were stemmy and prostrate in habit. In the year of planting the time of commencing growth was delayed till the beginning of August, and even then the growth consisted of only a few short trailing stems bearing a number of florets but very few leaves. Flowering commenced very early (the first week in August). Subsequent growth was limited in amount, and these plants were the first to die off in the summer (last week in December). The total production for this growing-season was extremely low. (See Tables 1 and 3.) As the result of heavy summer rains re-establishment from shed seed was very early (third week in January). For the next three months growth was rapid and production good. After cutting (early in May), these strains, together with all others, remained dormant till mid-July. Leaf-growth then commenced, and production has been quite good, but early maturity is indicated by the fact that flowering has been general during the last week in July of this year.

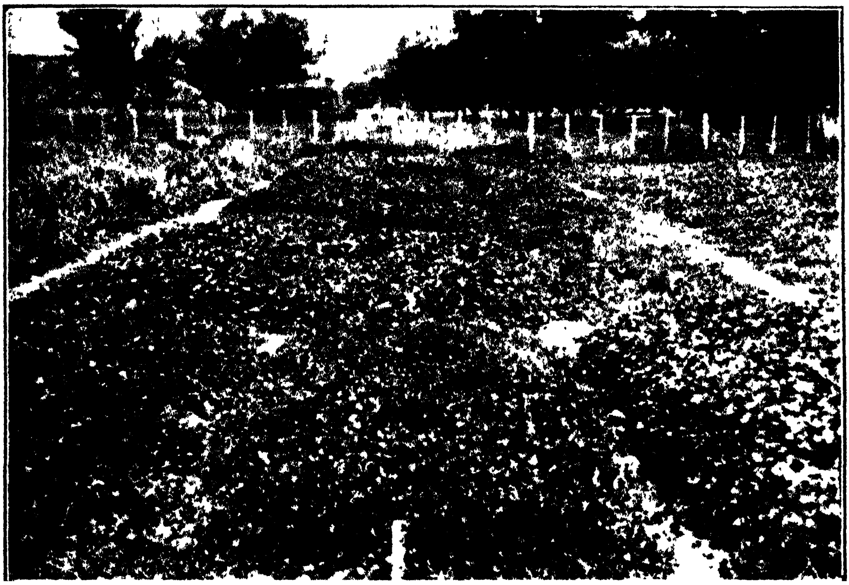


FIG. 4 SUBTERRANEAN-CLOVER TRIALS SHOWING THE TOTAL AMOUNT OF GROWTH UP TILL THE END OF SPRING.

Photograph taken 28th November, 1935

Foreground (left to right) : (*a*) Myall (*b*) Dahak (*c*) Wenigup
Second row (*a*) Mount Barker (*b*) Tallarook (*c*) Dwalganup
Third row . (*a*) Dwalganup. (*b*) Hill's Small-seeded (*c*) Wangaratta.

[*Photo by I. W. Gorman.*

Group 2.—The strains of this group are leafy and have a leaf-size greater than those of Group 1. In the year of planting growth was early and good right from the beginning of August till the end of December. The total yield of green herbage was very high. (See Tables 1 and 3.) The commencement of flowering varied between 13th September and 18th October. Good seed-setting followed. Re-establishment of seedling plants commenced before the end of January, and rapid growth followed. This group gave the highest production for the autumn period (see Tables 2 and 3), and has been able to make a moderate amount of growth in midwinter.

Group 3.- This group closely resembles Group 2 in that habit of growth, time of flowering, and seasons of production are as given above. The essential differences which define this group are—(1) Growth is very limited till after the beginning of September (one month later than that for Group 2); (2) total production is of good average only, being at all times considerably below that of Group 2. Autumn establishment and growth was good, but from the beginning of May till the end of July this group has been completely dormant.

Group 4.—When in full growth these strains are large-leaved, but throughout the early part of the spring they appear as small leafy rosettes, and productive growth does not start till as late as the last week in September. From that time onwards growth is very rapid and within the following eight weeks there is a greater yield of green material than is made by strains of any other group even when these others commence growth eight to ten weeks earlier. Flowering did not occur till after the middle of October, and these late strains continued to make good growth till the end of December, and actual death did not occur till mid-January (two weeks later than for other groups). This late dying-off was followed by delayed germination, and re-establishment was six weeks later than for Groups 1 to 3. Fairly good autumn growth followed till the beginning of May, after which growth remained dormant for a period of two months. Towards the end of July the plants of these strains appeared as small leafy rosettes, giving good ground cover but not making any productive growth.

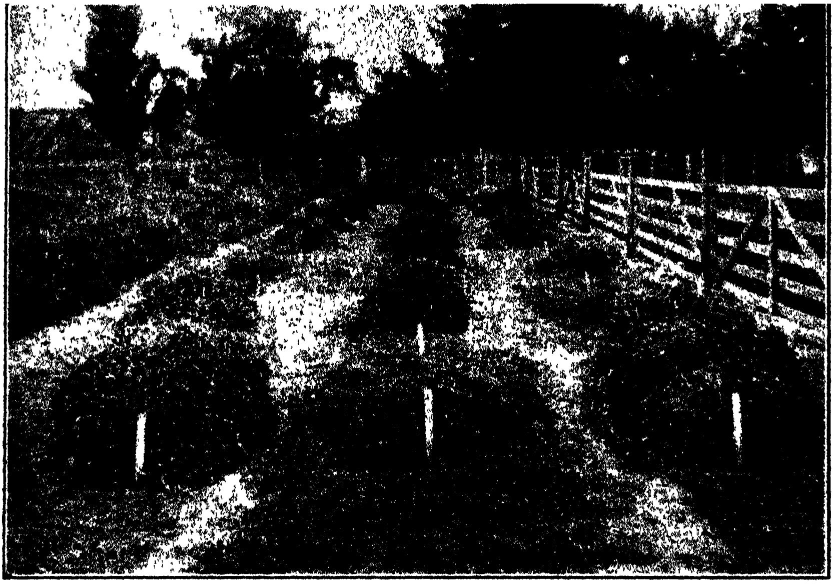


FIG. 5. SUBTERRANEAN-CLOVER TRIALS SHOWING THE TOTAL AMOUNT OF HERBAGE PRODUCED FROM THE LATE WINTER TILL THE END OF SPRING ON THE SAME PLOTS AS SHOWN IN FIG. 4.

These were cut and weighed on 29th November, 1935.

[*Photo by L. W. Gorman.*

TABULATION OF DATA REGARDING SEASONAL PRODUCTION.

Some indication of the relative production of each group can be ascertained by reference to Tables 1 and 2, which have been compiled from relative values (0–10) allotted to each strain at fortnightly intervals throughout the growing-period, which extended from mid-July of the one year to the beginning of May of the following year In these tables each group is compared with Group 3 = 100, since this group has given a fairly average performance at all periods of growth.

Table 1 — Production of each Group of Subterranean-clover Strains relative to Group 3 = 100 for the Period Mid-July to the End of December

—	Number of Lines.	Mid-July to End of December			
		Mid-July to 31st August	1st September to 30th September.	1st October to 29th November.	29th November to 23rd December.
Group 1	4	5·6	14·6	4·5	Nil
Group 2	5	131·0	145·7	133·6	30·8
Group 3 .. .	17	100·0	100 0	100·0	100·0
Group 4 .. .	7	100·0	86·7	102·0	272·0

This table shows the superiority of Group 2 right from late winter and throughout the spring. The low production and early death of Group 1 is emphasized, as is also the late-spring and early-summer growth of Group 4.

Table 2 shows the relative growth from the end of January till the end of July.

Table 2 —Production of each Group of Subterranean-clover Strains relative to Group 3 = 100 for the Period Late January till the End of July (i e, after Re-establishment from Shed Seed).

—	Number of Lines	Late January to End of July.		
		23rd January to 2nd March.	2nd March to 4th May.	27th May to 30th July
Group 1	4	38	123	633
Group 2	5	108	124	296
Group 3	17	100	100	100
Group 4 .. .	6	7	69	80

Here again Group 2 is consistently above the average. The relatively good autumn and winter growth of Group 1 is indicated, but although for June and July Group 1 appears twice as productive as Group 2 the total production even for Group 1 is quite low. The figures for Group 4 emphasize its late establishment, which is followed by relatively lower yields. (See also Table 3.)

THE STRAINS WITHIN EACH GROUP.

For the purpose of identification a number of "strain" names have been used in Australia, and samples sent to us have been referred to as being under one or other of twenty-five different names. The names of the strains which come within each of the Groups 1 to 4 above are as follows :—

Group 1.—(Early-flowering and low production) : Dwalganup, Daliak, Springhurst, Mulwala.

Group 2.—(Mid-season-flowering, early growth, very good production) : Burnerang, Myall, Nangeela, Bacchus Marsh.

Group 3.—(Mid-season-flowering, good average production) : Mount Barker (commercial), Mount Barker (selected), Western Australia, Kybybolite, Goroke, Wangaratta, Orford, Orford Selection, Hill's Small-seeded, White-seeded.

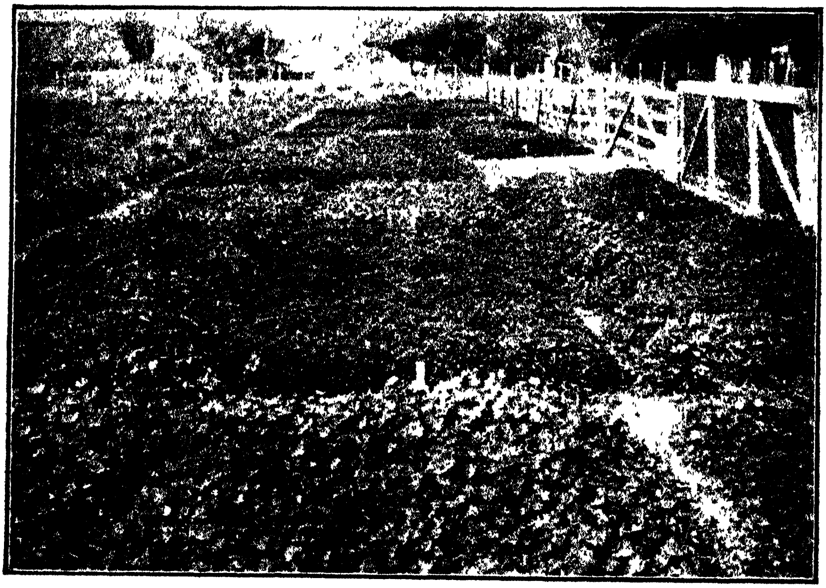


FIG. 6. SUBTERRANEAN-CLOVER STRAIN TRIALS

The growth shown is the total autumn growth following re-establishment from seed shed the previous summer At this stage rust infection occurred The photograph shows the Burnerang in the mid-foreground comparatively unaffected, whereas the surrounding plots each show a considerable amount of rusting Photograph taken 28th April, 1936 [*Photo by L. W. Gorman.*

Group 4.—(Late-season-flowering, late growing, but heavy production in the late spring) : Tallarook, Romsey, Bena, Kyneton, Macarthur, Wenigup, Bass.

These names seem to indicate places of origin of these strains rather than strictly distinct strains. In Group 2 Myall and Bacchus Marsh are indistinguishable as separate strains. In Group 3 the strains Mount Barker, Goroke, Western Australia, Orford Selection, Kybybolite, and Orford are morphologically and ecologically alike.

In Group 4 the names Tallarook, Romsey, and Bena are used for three strains which appear identical in every respect.

ECONOMIC IMPORTANCE OF THE DIFFERENT STRAINS.

The strains in Group 1 do not appear to be suitable for use in New Zealand on account of their low total production (see Table 4) and relatively early maturity, although their autumn and winter growth has been fairly good.

Group 2 contains strains which have grown particularly well at all periods. This is shown in the following Tables 3 and 4, which give actual green weights, also in Tables 1 and 2, which have been computed from figures allotted by an eye-estimation method.

Table 3.—Green Weights of Herbage (Pure Subterranean Clover) cut and weighed on 29th November, 1935, and again on 4th May, 1936.

—	29th November, 1935.		4th May, 1936.	
	Average Green Weight per Plot.	Yield relative to Group 3 = 100.	Average Green Weight per Plot.	Yield relative to Group 3 = 100.
	lb		lb	
Group 1	6·7	21	16·75	184
Group 2	41·32	129	17·9	197
Group 3 ..	32·0	100	9·1	100
Group 4	44·75	140	13·4	146

The total average yield for both dates then is as shown below:—

Table 4.—The Total Average Yield of Green Material from Both Weighings.

—	Total Average Yield per Plot	Yield in Tons per Acre	Yield relative to Group 3 = 100
	lb	Tons	
Group 1	23·45	9·15	57
Group 2	59·62	23·20	145
Group 3	41·10	16·00	100
Group 4	58·20	22·60	142

The two weighings were made at periods when seasonal growth was almost completed, so the figures giving total yields practically represent one year's production from a pure sowing of subterranean clover under local climatic conditions.

Each of the strains Burnerang, Nangeela, Myall, and Bacchus Marsh, which constitute Group 2, is likely to be of considerable economic importance in New Zealand, because of the exceptionally good total production, together with good growth at seasons when any clover-growth is exceptionally valuable—*i.e.*, winter, early spring, and early autumn. In growth-form the Burnerang is quite distinct from all other subterranean-clover strains tested. The plants themselves are characteristically erect leafy bunches of very slender stems and medium-sized leaves. (All other strains are prostrate and spread laterally.) The Nangeela is more like a large-leaved strong-growing white clover. It has leaves very distinctly marked with a white band across them. Both Bacchus Marsh and Myall appear like vigorous forms of the average commercial (Mount Barker) type. The essential difference noted is that in the Mount Barker at the base of the calyx-tube of the floret there is a distinct red-coloured band, whereas the calyx-tubes of both Bacchus Marsh and Myall are colourless at the base. The calyx-tube of Nangeela is light-green-coloured, and has no red coloration. Both the Burnerang and the Nangeela are able to make growth in the winter months and early spring, but Bacchus Marsh and Myall are more winter-dormant. The Myall is particularly good in the autumn.

Practically all of the subterranean-clover seed sold commercially in New Zealand in past years has been of the Mount Barker type. This strain, together with the others of similar type but differently named (see Group 3), can be relied upon to give reasonably good results, and until superior strains are available commercially the sowing of the Mount Barker type is quite worth while. Strains within Group 3 which differ slightly from the Mount Barker are the Wangaratta, Hill's Small-seeded, and White-seeded. The Wangaratta makes autumn establishment and growth rather later than the average for Group 3. Hill's Small-seeded and White-seeded are more slender and leafy than the typical Mount Barker, but the total production of each is low.

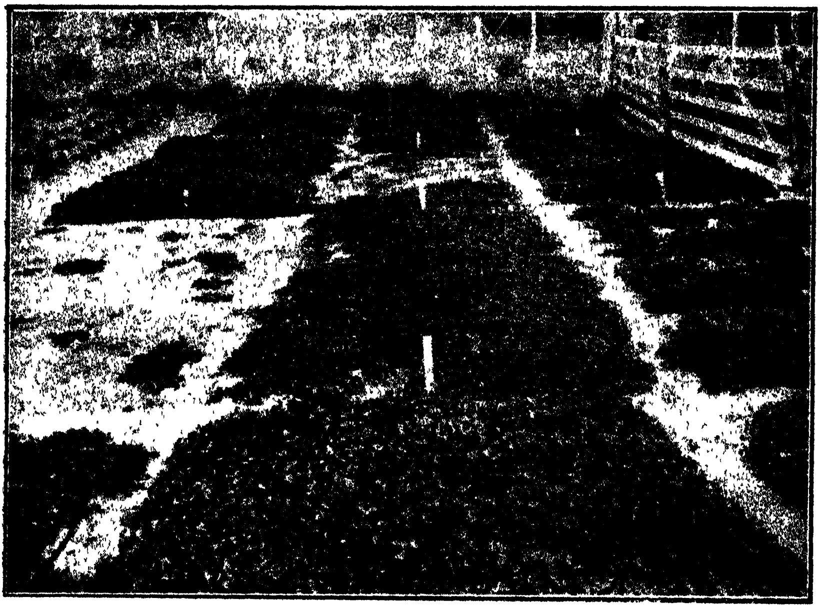


FIG. 7. SUBTERRANEAN-CLOVER STRAIN TRIALS.

Autumn re-establishment showing delayed germination and growth of the late-flowering strains. Date . 16th March, 1936.

Foreground (left to right) : (*a*) Kyneton (late). (*b*) Springhurst (early). (*c*) Burnerang (early mid-season).

Second row : (*a*) Bacchus Marsh (early mid-season). (*b*) Bena (late). (*c*) Orford (mid-season)

[*Photo by L. W. Gorman.*

A characteristic of Group 3 is its proneness to severe infection from leaf-rust (*Uromyces trifolii*). This was most noticeable in the autumn. Growth since the beginning of February had been very rapid, but by the end of March it had reached a stage of maturity, and at that stage the rust attack developed. The Hill's Small-seeded strain was the most severely infected. The strains in the other groups were only slightly affected, as the following figures show :—

*Table 5.—Relative Degree of Infection by Leaf-rust (*Uromyces trifolii*) on Subterranean-clover Strains within Groups 1 to 4*

(Heaviest infection - 100. At date 27th April, 1936.)

Group 3	100·0
Group 2	39·0
Group 1	29·0
Group 4	2·5

It will be noticed that the strains in Group 4 which were still growing were affected only very slightly In Group 2 the Bacchus Marsh strain, which was quick-growing in the early autumn, was rather severely attacked in this respect, being much worse than any other strain outside of Group 3.

Although the strains of Group 4 give a total yield about as great as that for Group 2 (see Table 4), the herbage itself is of less economic value, since it is produced relatively late in the spring and somewhat late again in the autumn, and, further, this high production extends over a limited period of approximately ten to twelve weeks only in either the spring or the autumn. Of the strains within Group 4 the Tallarook, Bena, and Romsey were outstanding for high total production of green material. The Kyneton, Macarthur, and Wenigup gave much lower yields. Each of the extra-late strains failed to germinate and establish quickly in the autumn. The Macarthur established the most quickly, and the Tallarook, Romsey, and Bena were next Comparatively few seeds of the Kyneton had germinated before the beginning of March, and this plot remained weak throughout the autumn The Wenigup completely failed to re-establish itself. This was most likely due to the date of cutting and weighing (29th November, 1935) interfering with flowering and seed-setting. The Wenigup was the only strain thus to fail so completely.

Since these extra-late varieties are capable of exceedingly high production, the ecology of this group as a whole requires further study. In any case, the Tallarook, Romsey, and Bena strains have proved superior to other strains of the same group, and it is quite possible that in practice these particular strains may prove equally as good as the commercial types now in use, and most likely at certain times of the year (particularly the early summer) the Tallarook, Romsey, or Bena would excel. The Tallarook, Romsey, and Bena strains each have florets with calyx-tubes either colourless or pale green at the base, and the stipules are green-veined (many other strains are red-veined). Another characteristic feature is that while the plants are in the rosette stage – *i.e.*, towards the end of winter– that portion of each leaflet nearest the petiole is a deep-chocolate colour. This chocolate area may cover half the area of each leaflet. Later in the spring this chocolate colour disappears.

STRAINS IN COMMERCE.

Until recently practically all of the subterranean-clover seed sold in New Zealand was of the Mount Barker type, but now Australian catalogues list supplies of the Dwalganup early and the Tallarook late as well as the Mount Barker mid-season strain, and it is known that some hundredweights of Tallarook seed have reached New Zealand this year. There is no direct report of any Dwalganup seed having been sown in New Zealand, but it is important to note that although this strain is being certified to by the Western Australian Department of Agriculture, and is specially recommended for use in districts of less than 20 in. of annual rainfall, where early maturity and seed-setting is essential, there is every indication that this strain is unsuitable for use in New Zealand.

CONCLUSION.

From a study of existing strain differences a classification of strains into well-defined groups has proved possible.

Burnerang, Myall, Nangeela, Bacchus Marsh, Tallarook, and Mount Barker appear to be strains well worthy of extended experiment and field trial. Botanical characters which aid identification of each of the above strains have been given.

Unfortunately, seed-supplies of Burnerang, Nangeela, Myall, or Bacchus Marsh are not available in commercial quantities, but at the present time while we are studying these strains we are also growing seed-increase blocks of the most promising strains. When seed-stocks are available it will be essential to have the growing, harvesting, and distributing of these strains protected by a system of seed certification.

LUCERNE-GROWING IN THE AUCKLAND DISTRICT.

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DURING the past few years a marked increase in lucerne acreage in the Auckland district has taken place. Whereas in 1929 a total of 2,667 acres was devoted to this crop, the acreage in 1935 had risen to 5,248. Of these totals, North Auckland had 210 acres in 1929 and 429 in 1935, while the acreages for South Auckland in the corresponding years were 2,457 and 4,819. These figures suggest that, so far as North Auckland is concerned, the crop is relatively unimportant at the present time. The reasons for this may be summarized as follows :—

(1) In the north the soils for the most part consist of stiff clays, which remain wet during winter months and dry out hard in the summer. They do not permit of free root-penetration, and consequently are not suitable for lucerne. In some districts there are restricted areas of basic volcanic soils sufficiently free to be favourable for lucerne growth. Such soils grow good crops, giving up to six cuts per annum over a period of three or four years, and occasionally longer, before they are invaded by paspalum and weeds.

(2) Crops are frequently affected by stem rot (*Sclerotinia* sp.), which rapidly spreads through the field, especially where cultivation of the stand is practised.

(3) In view of the high rainfall and the uncertainty of weather conditions, harvesting for hay is seldom done satisfactorily. Too many crops are spoiled through being treated as ordinary pasture-hay instead

of being allowed to cure in cocks. Consequently, the lucerne-hay crop is usually a mass of dry stalks devoid of leafage, and, as such, has little feed-value.

(4) The soils of the north where lucerne thrives are also well-suited for paspalum, which many successful farmers consider superior to lucerne. Furthermore, the clay soils can also be induced to grow good paspalum. Consequently, when it is remembered that paspalum does not present the same problems of management, establishment, and renewal, it will be readily appreciated why the northern farmer shows preference for this grass.

In the north there are restricted areas where lucerne does well. In such localities it proves quite useful in providing green feed, especially where paspalum is not well established. Likewise, on poultry-farms and small farmlets run in conjunction with orchards an area of lucerne is often grown to provide green feed during summer months, while silver-beet, kale, or chou moellier are used in the winter

In the South Auckland district lucerne is more favourably regarded. Rainfall, while not so high as that in the north, ranges about 50 in. per annum. Paspalum also thrives, particularly in the Bay of Plenty. It is in the types of soil that South Auckland districts show greatest variation from the north Whereas stiff clays are dominant in the north, pumice types are most commonly encountered in South Auckland Practically the whole Bay of Plenty district, extending from the coast on the north to Taupo on the south, and much of the Waikato consists of free pumice soils, while just south of Auckland fairly free basic volcanic soils are to be found Areas of peat, unsuitable for lucerne, are also scattered throughout these districts

On the open soils lucerne establishes well, and the free nature of the subsoil permits of good root-penetration. Excessive wetness in winter and summer baking are practically unknown. Experience with the crop has shown that four or five good cuts per annum can be expected on well-managed fields. As in the north, there are parts of the Bay of Plenty where paspalum in association with perennial rye-grass and white clover is to be preferred to lucerne Generally speaking, these areas are of high fertility where soil-moisture during summer is adequate for maximum paspalum-yield. There are other areas in this district, however, where the upper levels of the soil are far too dry in summer for high production from paspalum. On such soils lucerne, with its deeper root-penetration, proves more suitable. It is not claimed that all these soils yield heavy crops Some are far too low in fertility to do so, but their returns in lucerne are much greater than they would be in paspalum. There has been a pronounced increase in the acreage of lucerne in the Bay of Plenty, and this has also applied in parts of the Waikato, particularly in the counties of Matamata, Piako, and Waipa.

CULTIVATION.

On many farms the initial ploughing is delayed until late in the spring, after which disking, harrowing, and rolling follow at short intervals just prior to sowing down. This type of preparation leaves much to be desired, and many of the failures in establishment could be traced to hurried and inefficient cultivation. A good fine seed-bed does not result from hurried work. Ploughing should be done in the winter, and further working with disks and harrows should be completed in mid-spring. Such working gives reasonably good fineness, after which a roller can be used freely to obtain good consolidation. Where a roller is not available, use is occasionally made of stock to tramp the proposed lucerne field after the cultivation has been completed.

RATE OF SEEDING.

Where seed is being broadcast it is customary to sow from 20 lb. to 25 lb of seed an acre, and occasionally seedings range up to 30 lb. per acre. If drilled, the usual sowing is from 16 lb. to 18 lb. per acre. With these heavier sowings good strikes are obtained, but there is a tendency to overcrowding. Tillering is restricted, weakened .plants are common, and frequently there is fairly high plant mortality in the first year or two. The object underlying heavy seeding is to smother weeds, but measures to eliminate weeds prior to sowing would give better results. This could be accomplished by somewhat later sowings following continued cultivation to destroy seedling weeds as they appear. Under this method of preparation suitable seedings would be provided by 18 lb to 20 lb. an acre broadcast and 14 lb. to 15 lb. an acre in 7 in. drills.

METHOD OF SOWING.

The usual practice in the Bay of Plenty is to broadcast seed through a top-dresser, the seed being previously mixed with carbonate of lime or a mixture of superphosphate and lime in equal proportions. Where the areas are very small they are often hand-sown. In a few instances an ordinary grain drill is used, but, in view of the fact that little cropping is practised, few drills are available. Fortunately, lucerne establishes well when broadcasted on Bay of Plenty soils. In the Waikato, however, drilling of the seed appears to be essential to success: the usual practice in this district is to sow about 16 lb. seed per acre, drilling half the seed in one direction and the rest across the first sowing. Broadcast stands in the Waikato are often unsatisfactory the second year after establishment.

INOCULATION OF SEED.

There is little doubt of the necessity to inoculate lucerne in South Auckland districts. Numerous instances of failure resulting from sowing untreated seed could be quoted. Since the introduction of the Department of Agriculture's culture for treating seed, this material has almost entirely superseded other cultures and the soil-method of introducing bacteria. In view of the fact that stem rot (*Sclerotinia* sp.) causes widespread damage on many lucerne-fields in South Auckland, it is always dangerous to use soil as the means of inoculating a further lucerne area. This is being appreciated by the farming community, and has led to a definite preference for the inoculating cultures.

MANURING.

The usual practice is to sow from 5 cwt. to 1 ton of carbonate of lime an acre a week or so before seed-sowing. This is followed by 3 cwt. to 5 cwt. of superphosphate an acre either just prior to or immediately following the sowing of seed. A good proportion of farmers sow the superphosphate mixed with lime together with the seed. The manurial practices appear to be quite sound, although a more general sowing of lime at not less than 1 ton per acre would be regarded as sounder practice. Lucerne definitely requires a non-acid condition, and lime, in sufficient quantity, can provide this condition in the soil.

TIME OF SOWING.

Lucerne is sown in both spring and autumn Spring sowings are much more popular, as considerable difficulty in getting good establishment is experienced with autumn sowings. With spring sowings it is not uncommon to find areas being laid down from mid-September to mid-December. Most of the crops, however, are sown during the first fortnight in November. The very early-sown crops are usually smothered by spring weeds, and seldom show satisfactory results. Where it is known that spring weed-competition is likely to be a problem, early cultivation and further continued cultivation into December is certainly the best procedure to adopt in an endeavour to rid the land of weeds Where consolidation is good there is seldom any difficulty in obtaining good strikes from December sowings.

Autumn sowings cannot be recommended: heavy plant mortality occurs, and the farmer usually finds that he has to resow the field in the following spring.

CROP CULTIVATION

In the management of a lucerne-field consideration has to be given to the problems affecting each particular area. In some fields annual weeds are the chief problem. In others, twitchy grasses present difficulties, while in still others disease demands attention. It is obvious that such variation in problems demands similar variation in method of attack, and yet it is not uncommon to find lucerne suffering from all the above drawbacks on as many different farms receiving the same treatment. Let us consider mechanical treatment. Not uncommonly, lucerne-fields are well cultivated and manured in August If the chief problem happens to be annual weeds, this proves satisfactory. If, however, Indian doobj has to be contended with, such treatment merely rejuvenates it. Harrowing under these circumstances should have been delayed until January, when the hot dry weather assists in eradicating the weed. Where disease has invaded the field, any harrowing merely spreads it through the crop and hastens the destruction of the stand. Partly for this reason Waikato farmers, and a proportion of Bay of Plenty growers also, have discontinued harrowing and cultivating lucerne. In order to maintain vigour in the crop they rely on liberal phosphatic manuring.

GRAZING.

Generally speaking, grazing of lucerne should not be carried out, although there are times when feed shortages, pressure of farm-work, or shortage of labour make it difficult to avoid. Apart from the danger to stock, considerable damage can be done to the lucerne if unduly punished. Where it is known that lucerne will be grazed, the crowns can be protected if the previous cut is taken somewhat higher than usual. A fairly stiff stubble is thus produced, and is sufficient to keep stock away from the crowns for some little time.

Apart, however, from the damage to the lucerne-plant, stock-tramping brings about surface consolidation, which leads to invasion by grass and weeds, and often results in a marked reduction in yield.

Summarized, then, the position of lucerne in the Auckland District may be stated as follows:—

(1) In North Auckland the soil types and rainfall make paspalum-growing generally a more certain means of providing feed than does lucerne-growing.

(2) In South Auckland the soils and climatic conditions are suitable for the crop. Parts of the Bay of Plenty, however, are more adapted to paspalum than they are to lucerne.

(3) Success with the crop depends upon thorough cultivation, good consolidation, and spring sowings.

(4) In the Waikato drilling of the seed is essential to success.

(5) On all soils in the Auckland district inoculation of the seed or soil is necessary. The cultures obtainable from the Department of Agriculture are highly effective for this purpose.

(6) Liberal liming and manuring with phosphatic fertilizers is always desirable, especially at establishment.

(7) Grazing of lucerne is not desirable: it leads to grass and weed invasion.

(8) Cultivation should be regulated to suit the particular crop. Where stem rot is prevalent liberal manuring should replace any form of cultivation.

This article summarizes papers on lucerne-culture in the Auckland Province read at the 1936 Conference of the New Zealand Grassland Association by R. P. Hill and C. Walker, of the Fields Division of the Department of Agriculture.

SHEEP-PRODUCTION ON THE MOUNTAIN COUNTRY OF ASHBURTON COUNTY.

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THE sheep-runs of the Ashburton County cover roughly 590,000 acres of river-flat, foothill, and high mountainous country bounded on the south by the Rangitata River (with the exception of the Mesopotamia run of Butler's "Erewhon" fame). On the northern side the boundary is formed by the Rakaia River, and a straight line from the Rangitata through Mount Somers and Staveley Townships to the Rakaia roughly demarcates the plains land from the hills on the east, while westerly the runs extend back thirty and forty miles to the main ranges of the Alps.

On account of the extreme roughness of the country and the lack of suitable vegetation, the sheep do not graze on the high faces of the main range. Nevertheless, the Merino is mustered from the summer country at levels between 7,000 ft. and 8,000 ft., and within the shadow of the glaciers.

An important feature of the hill country of this county is the abrupt commencement of the high hills and the small amount of foothill country—*i.e.*, there is very little of that type of country which is sufficiently good and free from snow to maintain a ewe flock the year round and to dispose of wether lambs and surplus ewes for fat-lamb production on the plains -*e.g.*, between the Rakaia River and Mount Somers Township, which is roughly the northern half of the run country joining the plains, the total grazing capacity of the country that is able to carry only ewes and ewe hoggets and no wethers does not exceed 3,000 acres. Two-thirds of this number are on small grazing-runs leased by men who winter their ewes on farms within a few miles of their runs. Between Mount Somers and the Rangitata River a little more foothill country is present. The carrying-capacity of this area is roughly 28,000 ewes and ewe hoggets, and of these about 17,000 are on pastoral-run country. The remainder are on freehold runs. The total number of sheep grazing the whole area, including the foothill mountain country mentioned above, is about 173,000, of which only about half are ewes and ewe hoggets. The figures given serve to emphasize the point that the ewe country is small in area. This will again be seen when the importance of the runs as a source of surplus wethers and wether lambs for fattening and surplus ewes for fat-lamb production is discussed.

VEGETATION, RAINFALL, AND TOPOGRAPHY.

The runs of the Ashburton County lie behind, and are a modified extension of, a belt of brown-top country which has been depicted in Dr. Hilgendorf's map of the South Island showing the distribution of the various plant associations that are to be found. The aggressive nature of the brown-top is plainly seen throughout the run country, where it is a common exotic grass, and, together with fescue tussock, forms the chief members of an association formed by Yorkshire fog, sorrel and catsear, and the two previously mentioned grasses. Cocksfoot and suckling clover are found on the better areas. The heath, Leucopogon, *P. Colensoi*, and sweet vernal are found on the drier sunny parts. The snow tussock, *D. Raouli*, is common. The aggressive nature of the brown-top is also plainly seen in the cultivated areas, where a paddock which has been sown down with perennial rye-grass and clover three to four years previously is a sod-bound mass of twitch, while old paddocks are seen which have been laid down for many years and show no signs of reverting to the native tussock. Not only in the cultivated areas, however, which are a very small portion of the total, does one find this grass, but throughout the tussock flats and slopes. The successful establishment of brown-top is undoubtedly due to many factors. The soil is silty, not rich in quality, and inclined to be sour. The north-west showers make eradication difficult, while burning affects it less than the other grasses present.

The rainfall of this area is extremely variable, and unfortunately the rainfall gauges in existence are mostly situated at points around the edge of the hill country. It is a fact, however, that the north-west showers are very local and fall off rapidly as one travels from west to east. At Double Hill, for example, the average is 61 in. and the annual fall was 70 in. in 1934, while at Mount Somers the average is 38 in. and at Alford Forest 46 in., a distance of about 40 miles as the crow flies. As one travels east to the plains, so also the south-west rains become greater, but it is the summer nor'westers that frequently delay shearing and promote the survival of brown-top.

With the exception of the Alford Forest, situated on the edge of the hill country, the bush is confined to a few beech gullies, often insufficient to supply fuel.

The country consists of hills and high ranges lying between the gorges of the Rakaia and Rangitata Rivers. There is not, however, any definite arrangement of main range with subsidiary spurs leading to the plains. On this class of country the aspect of the land is all-important. The slopes facing north or north-east determine the amount of winter country—*i.e.*, country on the lower slopes of which the flock can be maintained during the period May-August reasonably safe from snow, or where the snow does not lie deeply for a long period. Flat land in this class of country has not the significance as when it is good agricultural land, since a run may have a large area of flat consisting of worthless river-bed or silt-flat which, with a slight slope from the sun, will be colder and wetter than a high slope facing to the sun.

CARRYING-CAPACITY OF THE HILL COUNTRY.

The carrying-capacity of the runs surveyed varies considerably both in sheep per acre and the proportion of ewes to wethers It is possible to grade the country into four main types and to indicate what variations exist. They are as follows:—

(*a*) *Half-bred Ewe Country*, which comprises downs and the best of the foothill country and covers about 11,000 acres, and which carries one sheep to the acre, and winters the hoggets with supplementary crops, hay, &c.

(*b*) *Half-bred Ewe Country with little or no Ploughable Land.*—This grade of country winters the ewes and carries one sheep to from 1 acre to 3 acres, except during the winter months, when the hoggets are sent to the plains. This type of country is slightly higher and rougher, and the hoggets are wintered away, either because there is not the shelter country for both ewes and hoggets, or because there is not a suitable area for growing turnips. This grade comprises about 40,000 acres, and carries about 19,000 sheep.

(*c*) *Half-bred Ewe and Wether Country.*—On this grade there is a considerable area of rough country suitable only for wethers. The hoggets are wintered away, but exceptions occur where there is good turnip-country and the hoggets are retained. The country runs one sheep to from 2½ acres to 4 acres. This country comprises about 159,000 acres, with a total of 59,000 sheep, of which 20,000 are wethers, the proportion of wethers to ewes varying from about one-third to one-half.

(*d*) *Merino Country.*—This comprises the roughest area, liable to snow and bounds on the unused country. The barren areas are large and have to be mustered for stray mobs of wethers. The carrying-capacity is not, however, below that of the half-bred country when calculated on the area of grass only. The number of wethers is about 31,000, with a total of all sheep of 81,000 on an area of about 233,000 acres—*i.e.*, one sheep to from 2½ acres to 4 acres. The hoggets and two-tooth ewes are wintered on the plains in all cases.

The following table gives the number of sheep of each breed or type, &c., and where a change is in progress the flock has been placed in that type which it is hoped to attain :—

Breed or Type.	Number of Sheep.	Number of Flocks.	Range of Size of Flocks.	Number of Ewes and Hoggets.	Number of Wethers and Rams	Acreage of Grass.	Lambing Percentage.
Merino	81,300	7	5,000–25,000	50,000	32,000	233,000	70
Corriedale	26,301	2	1,000–22,000	18,000	7,000	68,000	69
Romney-Merino half-bred	12,500	14	300–10,000	39,500	3,500	66,700	80
English Leicester - Merino half-bred	29,750	6	100–17,000	20,000	7,800	92,800	75
Totals	179,851	29		127,500	50,300	160,500	.

The lambing percentages on this type of country are variable from year to year both on and between runs. The variation is in the neighbourhood of 10 per cent. This has a direct effect on the number of surplus stock disposed of in the following autumn in order than stock numbers may be maintained

METHODS OF MANAGEMENT.

The management of this class of country is governed by the following matters: (1) Proportion of winter and summer country previously mentioned, (2) subdivision fences and natural boundaries such as creeks, high ridges, rock-bound gullies, &c. The importance of adequate fencing for the spelling of winter country, complete grazing of summer country, and the separation of wethers, ewes, and hoggets in order that the fullest use may be made of the country, deserves greater attention than it receives in many cases. It is true that runholders are still recovering from the effects of the slump, and that fencing on this type of country is a costly business—£80 to £100 a mile—yet the advantages of fencing are many The sheep and cattle make the fullest use of the summer country and are prevented from drifting back on to the winter country. The wethers can be kept back on the roughest areas, lambs can be weaned on to a clean spelled block, while a snow fence, preventing the sheep from drifting up into higher basins in the late autumn at the time when snow is due, is a valuable means of preventing mortality and the expense of snow-raking and mustering.

A further point with regard to fencing is the very limited use of cattle on these runs. In many cases the grazing of cattle as a means of control of rank growth in the gullies and flats instead of indiscriminate burning would be a better practice. The objection usually put forward is that the existing fences are not suitable, and the cost of erection of barb wire prohibitive. It appears desirable that some modification of the present system of owners erecting fencing subject to the right of compensation should be introduced. This system tends to hamper the man with a small capital. The reduction in mortality alone would, in many cases, pay the interest and sinking fund on a substantial amount of capital advanced for fencing.

Fencing is also the chief cost in the establishment of plantations and shelter-belts, and, while one usually finds a well-grown belt around the homestead, it is rare to find one elsewhere on the property. As these lands are extremely subject to the north-west winds, crops of hay and oats are often difficult to harvest, while cultivation in the spring may be hampered by the danger of the paddock "blowing." Again, as a way of providing a future source of timber and a shelter for stock, the establishment of shelter-belts and plantations is desirable.

SUPPLEMENTARY CROPS, HAY AND CHAFF.

The area subject to cultivation is very small in comparison with the total areas of each run. In some instances no cultivation is carried out. Under both sets of conditions the hoggets are, with exceptions, wintered on the plains by farmers who grow turnips especially for this purpose. This aspect of sheep husbandry will be discussed in a subsequent section. Where cultivation is carried out, supplementary crops consist solely of the various types of turnips, but usually the white-fleshed variety is raised since the growing-season is short. The ruling practice is to plough out of grass in the late autumn or early winter, fallow until spring, and cultivate the seed-bed for sowing in December and January. The land is left in the roughest possible manner through the winter, as a fine surface lifts with the frost and "blows" with the drying north-westers. Turnips are usually sown alone the first year, fed-off during winter, and the land ploughed again the following spring. This time turnips, perennial or Italian rye-grass, and red clover are sown, and in this way the paddock is grassed down again, forming a source of hay the following year.

Oats are grown as necessary feed for the team, hacks, and pack-horses. The usual oat variety is Garton's, and the crop is spring-sown. Autumn sowing is not satisfactory, owing to the severe winter. The oat crop is sometimes sown with grass as a means of getting the land back into pasture again.

It is probable that the establishment of cocksfoot would meet with success: one or two instances of excellent cocksfoot stands have been seen. It can be said that there is need for better pasture-establishment and pasture-management, and use of hay.

The small area of turnips grown on the run country (about 1,000 acres) is, of course, quite inadequate for the needs of such country, but climatic factors are involved which may have serious consequences. For example, where turnips are relied upon in winter the paddocks are liable to be covered with snow or at least frozen hard for days, and turnips under these conditions are of little value, especially for hoggets, which are extremely difficult to handle in snow under extensive conditions where sufficient hay or chaff to feed over a period to a large number of sheep is not carried. On most runs the amount of winter country which is "safe" is inadequate to carry hoggets and ewes without a reduction of the flock or risk of serious loss. This difficulty is surmounted by migrating the hoggets to the plains from May to August, where they are placed on turnips in various localities. This can be said to be a specialized aspect of sheep-raising. Suitable areas for turnip-growing exist where farmers produce this crop and sell at so much per acre, or per week, the farmer tending the hoggets and moving them to a "run-off" when required. In a few instances a runholder has his own farm on the plains. There are some points in connection with this migration which require consideration:—

(1) The Cost: The average cost of grazing on turnips is about 2d. per head per week for hoggets and 3d. per head for ewes. The buying of turnips on the plains means a considerable cash outlay—*e.g.*, with a

scarcity of turnips through crop failure the runholder will pay about £5 per acre, and 2,000 hoggets will require about 50 acres. In addition, a certain amount of hay is usually bought, while droving may cost £25 or thereabouts—*i.e.*, roughly, £300 is incurred, or 3s. per hogget. This is a conservative estimate.

(2) The tussock hogget is healthy and apparently not infected with parasites to any extent, while losses on turnips are sometimes considerable, and in wet weather sufficient hay is not on hand to maintain the sheep without turnips. Some runholders maintain that, providing a tussock block sunny and free from snow is available, it is better to send to the plains two-tooths and older ewes, which have a better resistance to parasites, and keep the hoggets on the sunny blocks of the run. Against this is the argument that the hoggets thrive better in the comparatively mild plains climate. In all cases, however, the winter migration allows a higher carrying-capacity, or, what amounts to the same thing, less mortality. As an example of this, a case is known where all sheep were wintered on the run, and the death-rate was 20 per cent. to 30 per cent. With a change in ownership the country was adequately fenced and the hoggets taken out to the plains The death-rate is now 4 per cent., the same number of stock go into the winter but a large surplus is sold, and by adequate winter feeding of hay, &c., the wool clip has been doubled. The increase in wool clip may be correlated with the introduction of excellent sires, but no Merino flock will clip an average of 10½ lb., which is obtained in the case quoted, without attention to all factors concerned It is the general opinion that stock numbers would have to be reduced one-fifth or more if the hoggets or ewes were not away for the four winter months. The small area of turnips grown on the run is fed to hoggets before going away to the plains or fed to the rams during winter. Again, in some cases they are conserved over winter for the hoggets in early spring when they return from the plains. It is estimated that about 22,000 hoggets and ewes are migrated annually, and some of these travel for a week in order to reach their new pasture.

THE MOUNTAIN AREA OF ASHBURTON COUNTY AS A SOURCE OF SURPLUS SHEEP.

The type of sheep carried on the plains farms of the county is largely the half-bred and fine three-quarter-bred which are mated to the English Leicester and Southdown ram for fat-lamb production. The run-country ewes are in keen demand for this purpose, coming from the hard hill country. They improve greatly in condition and have a sound constitution. The following figures indicate approximately the number and class of surplus sheep which are disposed of each year:—

Ewes (mainly full-mouth)	16,000
Wethers, store lambs (mainly wethers)	8,500

The ewes are disposed of at the Methven and Tinwald ewe fairs in March. Wethers are sold soon after shearing to private buyers. Similarly, the store lambs are drafted out at weaning-time in March and go to the plains for fattening on turnips.

BREEDS OF SHEEP FOUND ON THE RUNS.

On such country as that of the Ashburton tussock land personal likes for any particular breed are restricted by the vigorous environment to the Merino and its derivatives. There is, however, sufficient variation in climatic conditions to warrant the variations found within the area surveyed, although the method employed in obtaining a desired type may give rise to a good deal of undesirable variation, and instances occur where a run has fallen into the hands of men ignorant of the prevailing conditions who have introduced unsuitable types, with subsequent heavy mortality and disaster.

The following is a list of the types found, together with the number of flocks of each type :—

Breed or Type.	Number of Flocks.
Merino	7
Romney Marsh half-bred ..	14
English Leicester	6
Corriedale	2

Included in this list are four small grazing-runs which carry a few hundred ewes for eight months of the year and are grazed in conjunction with plain lands. These are situated between Mount Somers and the Rakaia River, close to the Alford Forest. The land is sour and wet, and Romney half-breds are carried on three of the runs.

In some instances a change of type is now in progress—*e.g.*, the Romney Marsh half-bred ram is being introduced into an English Leicester half-bred flock. Other instances are seen where the Merino ram is being mated to the half-bred ewe, which produces a come-back type of lamb. These in turn will be mated to the Merino ram, and so on. The production of a half-bred with certain desirable characteristics found in the Romney strain or the production of a Merino flock being the end in view. The mating of the coarsest-woolled half-bred ewes to the Merino ram, the progeny of which cross would be sufficiently fine in the wool to be mated back to a half-bred ram, is also a means whereby the breeder endeavours to obtain a type with the characteristics he considers suits his conditions yet gives him the maximum cash return. It is important to note, also, that in a very few cases does the farmer with the half-bred flock breed his own rams. He purchases them from a local breeder, who in turn has bred them from cast Merino ewes which he purchases from some Merino breeder.

Consideration of these breeding practices brings into prominence the variations which from genetic considerations must occur and in actual practice are known to appear, and which, by means of scientific methods, could be selected for and established in desirable types. The production of a polled type of Merino and the standardization of suitable types of half- and three-quarter breds are examples of problems which will possibly be encompassed with the aid of scientific methods in the future.

Most of the stations have large areas of barren country, shingle, and rocky tops, &c. On this type of country it is desirable to select a type possessing a close fleece, which will prevent the ingress of sand. Here the half-bred is at a disadvantage compared with the Merino. The whole problem is, of course, bound up with the value of surplus stock for fat-lamb raising. The Merino ewe or wether lamb is not as valuable as the half-bred, and the lambing percentage of the Merino is usually about 10 per cent. lower than that of the half-bred. In addition to this, the slower-maturing Merino is not put to the ram until she is a four-tooth. The half-bred ewe in some cases is put to the ram as a two-tooth, but the ruling practice in the county is to draft off for mating the well-developed two-tooths, which on the harder country will be about 50 per cent. of the total.

The Merino is, however, a better sheep for the snow than the half-bred, and musters off the high country better. Slightly more Merinos can be carried on the same area. The man utilizing half-breds has, however, the satisfaction of knowing that if the price of wool fails seriously he still has a second string to his bow in the superior half-bred carcass.

The preference for the Romney half-bred is on those runs which, although not the roughest, tend to face from the sun and to be wet and sour. These conditions arise on the front country around Mount Somers, and on such country the Romney half-bred is hardier and gives a slightly better lambing percentage, and it is favoured by store-lamb buyers and the purchasers of mature ewes for fat-lamb production. This conclusion has been arrived at not only by the comparison of different flocks on different runs, but by the experiences of men who ran the English Leicester half-bred and have since changed to the Romney strain on the same country.

CONCLUSIONS.

(1) There is considerable variation in existing types of sheep and breeding methods employed Improvement by selection and fixation of suitable types would be an advantage.

(2) In many instances fencing is inadequate, and there is need to facilitate the following points of management :—

- (*a*) The use of summer and winter country, with the conservation of winter feed, and to reduce the risk of stock losses through snow.
- (*b*) That a depleted area be spelled, and the seeding of existing vegetation be allowed.
- (*c*) To extend the use of cattle as a means of control of rank growth rather than indiscriminate burning. Burning once every three to four years, except where growth is rank, is considered sufficient.
- (*d*) That the establishment of plantations and shelter-belts be extended to provide timber, to shelter stock, and to facilitate cultivation under adverse conditions.

THE CHINESE GOOSEBERRY.

J. W. WHELAN, Orchard Instructor, Palmerston North.

THE Chinese gooseberry (*Actinidia chinensis*) is related to a family of climbing shrubs often cultivated for their handsome foliage, and at times for the edible fruit produced on some species.

Actinidia chinensis is a deciduous, diœcious, climbing shrub or vine. Although recognized as being frost-tender, it appears to withstand light frosts fairly well. Apparently this plant is cultivated to some extent in Central China, from which country it was introduced to New Zealand. Although it is not extensively cultivated at the present time, it may be grown successfully in certain portions of this Dominion, not only for ornamental purposes, but with profit to the grower, as the fruits—commonly known as Chinese gooseberries—find a ready sale with an increasing demand at 6d. to 9d. per pound.

It is of very vigorous growth and comes into bearing the third year, if propagated by grafting. The current year's growth is dark-green in colour and covered with a mass of short hairs of bright red colour: later this colour changes to brown. It is quite a common occurrence for eight to ten vine-like growths to develop from the one stool during the growing-season. Such growths may vary from 18 ft. to 21 ft. in length.

PROPAGATION.

Young vines are easily raised from seeds. However, this method of propagation is not recommended because it is impossible to differentiate between male and female plants until flowering has occurred. Propagation by grafting is recommended. Many nurserymen propagate by grafting, and as a result it is now possible to purchase a guaranteed pair, male and female. Apart from the necessity of planting a vine of each sex, necessary for the production of fruit, grafted vines come into bearing at least two years earlier than seedlings. Both sexes grafted on the one stock have proved successful: this may be achieved by grafting a strong female scion and a weak male scion on the same root.

FRUIT.

The fruit is produced on one-year-old and older wood. It varies in shape from almost round to oblong. It is brown in colour, and covered with a comparatively tough skin which is studded with a mass of short hair-like growths. The flesh is soft, dark-green in colour, with numerous minute seeds arranged around a white soft core. When fully ripe the white core disappears. The flavour is very similar to that of an ordinary well-ripened gooseberry of the greengage variety. Harvesting takes place from about the end of May to mid-June Usually at this time the vines are bare or practically bare of leaves, and the fruit being fully exposed may be picked easily. It keeps for four or five months, and may be utilized for jam and jelly. It provides a fresh dessert fruit during the winter months.

CULTURE.

Rich, loamy soil, well drained, appears to be ideal for this plant, notwithstanding the fact that once the fruit has formed a good water-supply for the development of large fruits is essential.

Apparently there are no pests or diseases attacking the vines at the present time.

There is some scope for experimental work in respect to the pruning and general treatment of this plant. At the present time little or nothing is done with the exception of training the vines along wires or over trellises. Pruning may or may not be beneficial in improving the quality and quantity of the fruit. It should, however, facilitate cultural operations.

The question of laying out a plantation to the best advantage requires careful consideration, particularly in respect to the distance

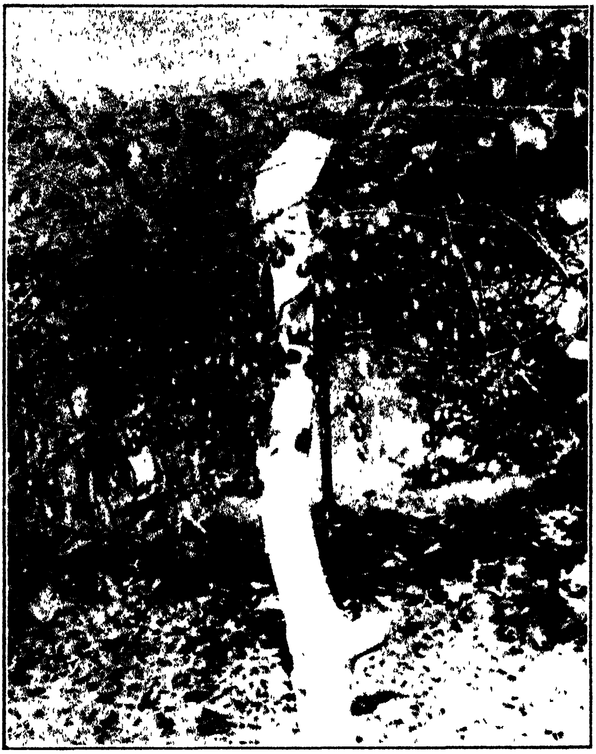

FIG. 1. DEPICTING A PORTION OF THE PLANTATION WITH, IN THE FOREGROUND, ONE OF THE POLES SUPPORTING THE WIRES.

Note the fallen leaves on the ground a normal condition at harvesting-time.

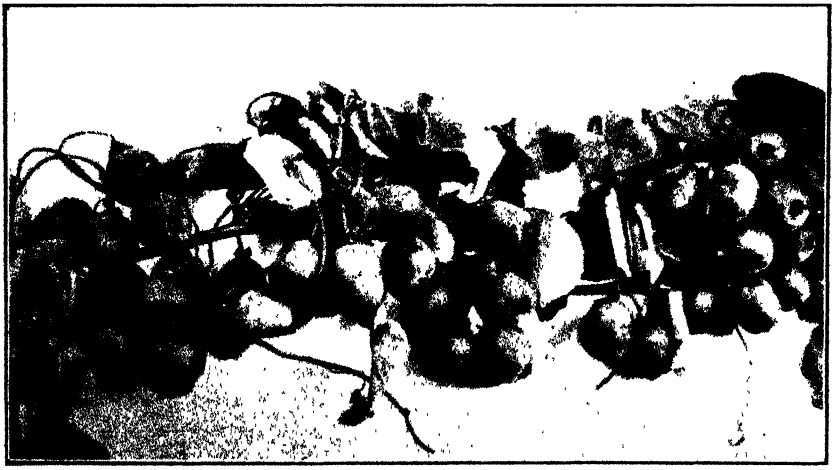

FIG. 2. PHOTOGRAPH OF A FRUIT-BEARING LATERAL TAKEN FROM THE SAME PLANTATION.

This lateral was carrying fifty fruit when first taken from the vine. Note the furry appearance of the fruit, due to short hair-like growths.

apart for planting, the method adopted for training the vines, and the number of female vines to each male vine. The accompanying illustrations, taken in a commercial Chinese gooseberry plantation at Wanganui, give a very good indication of the prolific crop that may be anticipated when grown under favourable conditions of soil, climate, and cultivation.

The plantation consists of sixty vines set out in stools 9 ft. apart on the square, one male to six female vines. Alongside each stool a pole 8 ft. high from the ground-level is erected. Ordinary No. 8 fencing-wire is stretched along the top of each row of poles each way, the ends of the wires being anchored in the ground. This arrangement allows each vine to climb up its respective pole and then along the overhead wires. Two tons of fruit, it is estimated, were gathered from this plantation during the 1936 harvest.

A suitable site for a plantation probably is one with a northerly aspect, immune from frost if possible, fully open to the sun, well drained, and adequately sheltered from prevailing winds. It is reasonable to suppose that beneficial results would follow the cutting-away of all weak and superfluous growths, and confining the number of vines or rods to, say, six or eight per root. It may also be found advantageous to shorten back the vines, and instead of allowing them to ramble at will to train each one along a wire or trellis. There also appears to be scope for experiment relative to the distance apart for setting out vines: the present method of 9 ft. apart seems much too close on a rich soil, and results in a tangled dense mass of growths. As one year's growth of each rod or vine may reach a length of approximately 20 ft., it appears that the vines might be set out at about 20 ft. or 25 ft. apart.

INTRODUCTION OF THE CHINESE GOOSEBERRY INTO NEW ZEALAND.

Over twenty years ago a gentleman living at Wanganui raised plants from seed that he imported from Central China. Many of these plants he distributed to friends living in different parts of the country, three vines going to Fielding. At this time little was known regarding the habits and nature of the plant, or that to produce fruit it was necessary to plant both sexes in proximity, for fertilizing purposes. As it happened, however, of the three vines that went to Fielding, one proved to be a male (possibly the only male raised from the imported seed). These three vines thrived, and in due time produced fruit. So far as is known, these are the only original vines which survived and bore fruit.

WOOL INDUSTRY PROMOTION ACT, 1936.

THIS Act imposes a levy on all wool produced in New Zealand, the proceeds of which are to be utilized for advertising or publicity purposes and for wool research, with the object of increasing the production and use of wool.

The Act provides for the setting-up of a Committee called the New Zealand Wool Publicity Committee, a body corporate, which is charged with the administration of the proceeds of the levy, and which consists of one Government representative, four wool-growers' representatives, and two associate members—namely, the Director-General of Agriculture and the Secretary of the Department of Scientific and Industrial Research. All members other than the associate members are appointed by the Governor-General, the wool-growers' representatives being appointed on election by the wool-growers of the Dominion in accordance with regulations to be prescribed ; but pending the enactment of the necessary election regulations, and with a view to the early appointment of members of the Committee, the first members to represent the wool-growers may be appointed on the recommendation of the Minister of Agriculture, to hold office until 30th September, 1937. The personnel of the Committee so appointed is as follows :—

H. M Christie, M.P , Waipawa, Government Representative, and Chairman.
H. D. Acland, Esquire, Christchurch, Wool-growers' Representative.
B. E. H. Tripp, Esq , Timaru, Wool-growers' Representative.
A. W Douglass, Esq., Waikouaiti, Wool-growers' Representative
Sir William Perry, Masterton, Wool-growers' Representative.
A H. Cockayne, Esq , Director-General of Agriculture, Associate Member
Dr E. Marsden, Secretary, Department of Scientific and Industrial Research, Associate Member

The Associate members have full rights of discussion at meetings but no voting-powers.

The functions of the Committee are—(*a*) To promote the use of New Zealand wool in existing or new markets by such methods of publicity or other means as commend themselves to the Committee , (*b*) to promote, by way of subsidy or otherwise, scientific or industrial researches in relation to wool or sheep with a view to improving the quality of New Zealand wool or increasing its production, or the discovery of new or improved methods of utilizing it, or generally in connection with the wool-production industry ; (*c*) to act in combination or association with similar bodies overseas having similar functions.

The levy imposed by the Act applies to all wool produced in New Zealand which is either exported or delivered to a wool-manufacturer for use in New Zealand The Minister of Agriculture is required to fix the rates of the levy for each season ending 30th September, but the rates so fixed must not exceed 6d per bale, 3d per fadge, and 1d. per bag or sack. The rates of the levy fixed by the Minister for the current season are the maximum rates prescribed by the Act In the case of wool exported the levy is payable to the Collector of Customs at the port of entry for export. In the case of wool intended for use in New Zealand the levy is also payable to the Collector of Customs by the wool-manufacturer acquiring the wool. Every wool-manufacturer is required to render to the nearest Collector of Customs a monthly return of the quantity of wool delivered to him, and the amount of the levy must accompany the return. All amounts paid in levies are deemed to have been paid on behalf of the wool-grower, and may be recovered from the wool-grower accordingly. An allowance for the levy to be paid by the eventual exporter or by the wool-manufacturer may be made in all transactions of sale and purchase of wool so that the levy shall, in fact, be borne by the wool-growers, whose representatives have full control over the disposal of the proceeds, less the cost of collection by the Crown.

The Committee in the exercise of its powers and functions may apply its funds in payment of the travelling-expenses of members (not being officers of the Public Service), the salaries of officers of the Committee, and the fees or other remuneration of members in respect of their services. The amount of such fees or other renumeration must, however, be approved by the Minister of Agriculture.

—A. E. Morrison, Solicitor, Department of Agriculture, Wellington.

GOVERNMENT OFFICIAL HERD-TESTING.

In the summary of the 1935–36 season's work appearing in the January, 1937, *Journal*, Table 1, on page 34, gives a wrong set of figures under the heading *Season 1935–36*: The correct figures are as follows:—

All Purebred Cows on Test 180 Days and over, Season 1935–36.

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days.	Milk.	Butterfat.
Jersey	156	1,259	286	6,062·1	332·56
Friesian	15	363	289	8,850·1	315·38
Milking-Shorthorn ..	4	105	282	7,612·2	313·24
Ayrshire	1	6	305	5,455·0	241·91
Red Poll	1	17	274	5,589·3	227·15
Guernsey	Not represented				
Shorthorn .. .	1	3	242	6,800·2	250·92
Totals and averages	175*	1,753	287	6,726·9	326·32

* Total does not agree, since some breeders tested more than one breed.

—*Dairy Division.*

According to regulations gazetted on 8th January last, " no person shall have any bird-lime in his possession or sell or agree to sell or offer for sale or purchase or agree to offer to purchase any bird-lime ; no person shall use bird-lime for the purpose of capturing or attempting to capture birds Offenders against these regulations are liable to fines of £5 on summary conviction, £10 for a second offence, and £20 for any subsequent offence.

For BIGGER and BETTER CROPS OF WHEAT, OATS & BARLEY

dress all your seed with:—

'CERESAN'
BAYER'S DRY SEED DRESSING
(U.T. 1875 a.) TRADE MARK

BRITISH MADE

'CERESAN' gives:—

BETTER GERMINATION

BETTER CONTROL OF DISEASES

BIGGER YIELDS OF A BETTER TYPE OF GRAIN.

BAYER

»Bayer« MEANS BETTER

SEASONAL NOTES.

THE FARM.

Some Aspects of Feed-provision in Sheep-farming.

Two features of sheep-farming are of particular practical importance at present.

In the first place the high ruling prices for sheep and for the main products in sheep-farming make it increasingly desirable both to lessen losses due to avoidable deaths in the flocks and to increase the returns from each unit of production; each sheep that dies now is a greater loss than was the death of a similar sheep in the recent past, and quite often each producing unit is associated with an increase in depreciation and in other items in the cost of production.

In the second place, it is well established that in stock-mortality, in lamb-production, and in wool-production much depends on the feeding of the sheep throughout the year, and particularly on the feeding during the winter and early spring months.

That there is a connection between the feeding of sheep and their disorders and diseases generally is understood, but quite often it seems to be understood in really an inadequate and hazy fashion that does not lead to the due measure of attention being given to the work with pastures and crops that brings about proper feeding. Hence some of the major instances in which there is relationship between the feeding and the troubles of sheep seem worth noting. For instance, ante-partum paralysis or "dopiness" of ewes is a nutritional disease definitely associated, as a rule, with ewes falling off in condition at the approach of lambing. The incidence of "bearing" trouble is considered often to be connected with the type of feed. Underfeeding at some period during pregnancy is commonly accepted as an important cause of premature births of lambs, of dead lambs in the womb, and of lambs dying or being weak or small at birth. Veterinary research tends to show that rickets is one of the causes of losses in hoggets during the winter and spring months, and so it is of practical significance that rickets can be produced experimentally by feeding a diet deficient in its content of minerals—*e.g.*, lime and phosphates. Nutritional measures form one of the first lines of defence against internal animal parasites. The value of good feeding in combating such parasites often is ignored in practice; drenching without good feeding is apt to give unsatisfactory results. Regarding this point the Director of the Live-stock Division, in the 1936 annual report of the Department of Agriculture, states,—

"In attacking the problem of internal parasites of sheep too much reliance must not be placed on the specific action of any anthelminthic agent whilst neglecting the maintenance of the lambs' strength by the provision of extra suitable supplementary feed. In this respect the feeding of chaff, oats, and good hay will be found to produce good results. The difficulty which is said to be experienced in getting hoggets to eat hay in the early winter might be overcome by educating them earlier to take it. . . The benefits of such practice are indicated in seasons when through abnormal conditions the pasture . . . cannot be maintained in that short condition which provides the best sheep feed."

Incidentally it already has been indicated herein that feeding has a considerable influence on the percentage of lambs obtained. The ewe that inherits the capacity to produce twin lambs does not necessarily give birth to twin lambs; with unsuitable feeding or management she may produce only one lamb or none. Only under proper feeding and management can she produce the two lambs. Further, feeding affects the fertility of sheep—*i.e.*, their ability to produce living, healthy offspring, which, alas, often differs substantially from their fecundity. The number of lambs to be produced is determined at the time of mating, and subsequent feeding does not affect this number, but it may greatly affect how many of the total lambs produced are live and healthy lambs.

Apart altogether from diseases and disorders of sheep, feeding may influence the production of fat lambs and of wool. That the direct influence of feeding in fat-lamb production may be substantial has been indicated strikingly by work of Canterbury Agricultural College. In this work it was found that a difference in feeding not especially great was correlated with a difference in the weights of lambs at birth. The lambs of one mob averaged 9·7 lb. whereas those of another mob not fed so well averaged 7·7 lb. The true significance of this difference is shown from the relationship between the weight at birth of lambs and their subsequent development. In the work under consideration, lambs 6 lb. to 7 lb. weight at birth made an average increase in live-weight equivalent to 20 lb. in fifty days, while lambs of 9 lb. to 10 lb. and lambs of over 13 lb. live-weight at birth made increases of 26 lb. and 32 lb. respectively. Expressed in another way the largest lambs grew 60 per cent. more rapidly and the lambs intermediate in size 30 per cent. more rapidly than the smallest at birth of the lambs being considered. In conjunction with this should be taken into account the further fact that increased rapidity in growth begets economy in the quantity of feed consumed. This is rather well illustrated by the following data which make clear the contrast between the position relative to lambs light at birth and that relative to lambs heavy at birth: only two out of every five of the light lambs were fattened by 1st March, and only one out of ten was fattened off the mother, while all the lambs heavy at birth were fattened by 1st March, and two out of every three of them were fattened off the mother.

The foregoing statements form a serious indictment of inadequate feeding in sheep-farming; in short, an attempt has been made to indicate that poor feeding frequently is connected causally with diseases and disorders in the flocks, and that, apart from this, parsimony in feeding brings about readily a low standard of efficiency in the conversion of feed into flesh.

All this leads up to the matter of outstanding importance. in sheep-farming a weakness that is both widespread and grave generally rather than slight is poor feeding of the flocks in winter and early spring. The weakness probably would be lessened rapidly if it were more spectacular. But it does not altogether " strike the eye " ; it is an insidious rather than an open weakness ; typically it results in a somewhat heavier mortality in ewes, a decrease in twin births, an increase in lambs dead at or shortly after birth, a heavier consumption of feed to reach slaughter stage of lambs, and a bigger " tail-end " of lambs requiring feeding on rape or other special crop. Possibly no one of these by itself is really serious, but, taken together, they may have an influence great enough to make the difference between success and failure.

Current Measures to strengthen Feed Position in Winter and Spring.

The practical question of current importance is what may now be done towards remedying the common weakness. Foremost of the measures suitable for this purpose is phosphatic top-dressing in late summer or autumn.

Top-dressing.—Phosphatic top-dressing has been found to give results financially attractive on sheep-farms over a wide range of conditions of soil and climate, including not only farms in districts of relatively heavy rainfall, particularly in the North Island, but also ones in districts of somewhat low rainfall on the eastern side of both the North Island and the South Island. In all cases in which it is fitting to sow truly perennial strains of such species as rye-grass, cocksfoot, white clover, and red clover, and in which such strains have been sown recently enough not to have been replaced already by inferior pasture species or by weeds, then profitable results may be counted upon from phosphatic top-dressing. In short, swards which contain a fairly substantial number of plants of the better pasture species may be expected generally to respond profitably to phosphatic top-dressing Even though these plants of the better species are small and possibly far from prominent in the sward, they serve as a valuable foundation upon which to build a sward in which ultimately they tend to become dominant as the level of fertility is raised by successive phosphatic top-dressing and its associated beneficial results, such as the strengthening of the nitrogen content of the soil by clovers invigorated directly by the phosphates.

Replacement of Inferior Swards.—When swards are wholly or almost wholly lacking in plants of the better pasture species, the position is not so straightforward. Usually in the case of arable land it is advisable to break up such inferior swards and to replace them by ones containing a better foundation for good response to phosphates Underlying this is the view that phosphates are likely to be more profitable when stimulating such species as rye-grass, cocksfoot, white clover, and subterranean clover than when stimulating such plants as brown-top, suckling clover, and even weeds During recent years the economic soundness of ploughing inferior swards and replacing them by ones rich in such species as rye-grass, &c., already mentioned has been well demonstrated on sheep-farms in Canterbury and Hawke's Bay, as well as in other districts in which there is longer and more extensive knowledge that phosphatic top-dressing is profitable under the conditions prevailing.

Sward-improvement by Surface-sowing of Seed.- Sometimes, and this most usually because of the rough or broken nature of the land-surface, it is not practicable to plough inferior pastures and replace them by better ones; sometimes it is practicable but not economically attractive to do so, as in the case of light or dry soils in eastern districts of both Islands. In both of these sets of circumstances the possibility of strengthening of poor swards by the surface-sowing of suitable species, and especially of subterranean clover, should be examined Some of the available experience relative to the use of subterranean clover for this purpose is given in the January, 1937, issue of this *Journal.* The use of subterranean clover in such circumstances is an application of the fact that subterranean clover often enables phosphatic top-dressing to be exploited on country where it would not be economic without subterranean clover.

At times, in top-dressing sheep country, it pays to supplement phosphates by other top-dressing materials, but phosphatic fertilizers may be looked upon as the basis of any top-dressing programme. Specific guidance about the top-dressing of pastures is obtainable from district officers of the Fields Division.

Special Arable Crops.—Sheep-farmers now also may valuably improve the position in respect to feed for winter and spring by growing suitable special crops, the culture of which has been dealt with in these notes in the two issues of the *Journal* preceding this, and is referred to subsequently herein.

Work with Special Crops.

The proper growing of forage crops sown in late summer or early autumn may serve valuably to provide, later on, feed which is much needed. Land from which such crops as oats, wheat, maize, millet, soft turnips, or rape have been removed recently, if sown immediately in temporary pastures, or cereals, may be expected to strengthen appreciably the feed position in winter and in spring. If the land to be sown in such crops is so hard as to make satisfactory skim-ploughing impracticable, then cultivation with disks set with plenty of "cut" frequently will serve satisfactorily as an alternative to the skim-ploughing. In preparing for such crops it is not necessary to reduce the surface-layer of the soil to a fine condition. In fact, the presence of clods in the surface soil may be an advantage by obviating the caking of the soil that at times is brought about by rain beating on soil of a fine surface. These crops, and especially the temporary pasture, should be sown with as little delay as possible. They serve well, not only for sheep and cattle, but also for pigs: they become available when the feed directly available from the pastures is likely to be harmfully scant.

Every year areas of maize and of millet intended for green-feed are allowed to become too woody or are cut down by frosts. It is preferable to utilize such crops earlier and to use the land thereby rendered vacant in growing the fall-sown special crops mentioned just previously. Maize or millet that cannot be used advantageously as green-feed should be turned into silage provided sufficient is available to enable this to be done without the unduly high proportion of waste that is unavoidable in making small quantities of silage.

Often during March a cut of hay or green-feed is available from fields of lucerne. After such a cut, if weeds call for attention and if the conditions are dry, it is likely to be advantageous to give the crop a stroke of tine harrows or other suitable harrows possessing teeth with the fine points needed to avoid undue injury to the lucerne plants. Relative to such work it should be kept in mind that at times more harm than good has been done by cultivation of lucerne. Cultivation, unless a fairly prolonged spell of subsequent dry conditions can be counted upon, is likely at its best to be merely futile, while repetition of cultivation, which to destroy weeds has to be so severe that it also destroys some of the lucerne-plants, inevitably leads to an undesirably weak open "stand" of lucerne. Generally liberal manuring, the refraining from grazing, and the mowing of the crop at the proper stage are preferable to surface tillage as means of controlling weed-invasion of lucerne.

General Considerations regarding Pasture Establishment.

At the time of writing the number of samples of the 1937 harvest which have been tested is not great enough to indicate definitely the standard of the whole new seed-crop, but there is evidence that the germination-capacity of the seed will vary so greatly as to make it distinctly advisable to purchase pasture seeds on the basis of guaranteed germination-capacity.

Each successive year adds to the extensive evidence from farms of the superiority of certain strains of pasture species over other strains which are in commerce. The only assured way of obtaining the superior strains is the purchase of certified seed. Certified seed embraces a "commercial grade" of seed as well as the "permanent pasture" and "Mother" grades of seed with which farmers and merchants have had longer acquaintance. The "commercial" grade of seed normally is less costly than the other grades when all are of corresponding germination-capacity and purity. Further, the commercial grade of seed is eminently suited for a wide range of use. Full particulars about the different grades of certified seed are available from district officers of the Fields Division.

Top-dressing at or about the time of sowing pasture-seed mixtures often greatly assists in bringing about vigorous successful establishment. It is well to top-dress young pastures early, in time to prevent deterioration, rather than to find it necessary to apply fertilizer later in an endeavour to build up pasture which has deteriorated.

A common cause of unnecessarily and regrettably poor results in pasture establishment is the sowing of the seed at too late a date in the fall of the year. March sowings widely are to be recommended.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Spraying.

FOR the control of codling moth and leaf-roller caterpillar in mid-season and late varieties of fruit, it still is necessary in many localities to continue spraying with arsenate of lead, at the rate of 1½ lb. to 100 gallons of water. All codling-infected fruits should be picked and destroyed regularly.

At this period of the year conditions are frequently favourable for the development of black-spot, and, therefore, a careful watch should be kept in clean orchards to detect the first indications of the appearance of this disease. In some localities this late infection often appears between the middle of February and the third week in March. Apply lime-sulphur (polysulphide content 15 per cent.) 1–180. When red mite or apple-leaf hopper are in evidence add nicotine sulphate 40 per cent., 1–800, or spray with summer-oil (1–80) two applications. An interval of from seven to ten days between the applications is desirable. At least fourteen days should be allowed to elapse before applying summer-oil following a sulphur spray.

Stone-fruit affected with any fungous disease should be sprayed, as soon as the fruit is gathered, with Bordeaux mixture 3–4–50. Brown-rot-infected fruit should not be allowed to be about the ground, but should be gathered and destroyed.

Drainage.

As opportunity offers, the drainage of heavy retentive soils should be attended to, as badly drained soil is not profitable orchard land. In well-drained land the soil is more congenial for the roots of the trees in the spring and during wet seasons than is the case in wet cold undrained land. Where drainage is necessary, it should not be put off for another year, but should be attended to as soon as possible.

Drainage allows the land to be worked earlier in the spring, makes it easier to work down to a fine tilth, and also prevents the souring of the soil. Tile drains, though more expensive, are the most permanent type of drain and give the best results in the orchard. The diameter of tiles for main drains should be at least 4 in. Soft boggy places in an orchard are often caused through seepage of water from a higher level, and in such cases a cross-drain located above the orchard and of sufficient depth usually cuts off the seepage water. After draining the land it should be well limed in the autumn or early winter. Existing open drains should be cleaned out, and the outlets to pipe-drains cleared so as to let the water pass freely away. Broken pipes should be replaced with new ones.

Budding.

Budding may still be practised on trees in which the sap is flowing freely.

Harvesting.

Mid-season varieties of stone and pip fruits are at or are nearing the stage of maturity when they are in a fit condition for picking for the respective markets or for storage. Picking and handling of fruit is a phase of orchard-work which requires much skill. The percentage of loss and wastage due to bruises and skin punctures caused at picking and in the subsequent handlings is much greater than it should be, and is striking evidence of the need of greater care in handling the fruit. A fact that should not be lost sight of is that the product of the year's work is being handled. A satisfactory realization is largely dependent on the condition in which the fruit reaches the market. Damaged fruit frequently opens up in a very unsatisfactory condition, with dark ugly bruises, with skin punctures, and frequently is badly decayed. Damaged fruit should be disposed of with as little delay as possible, and should not be placed in storage.

Grading and Packing.

There is a good demand for well-graded and well-packed fruit. The fruit-merchants, the retailers, and the consumers seek the best fruit, and there is an ever-increasing inquiry for this quality of fruit put up in a uniform manner. During the period of " gluts " well graded and packed consignments have always been disposed of at a satisfactory figure, while, alongside, less carefully graded and packed consignments have not attracted buyers when offered at very low prices

Growers are known to the regular buyers by their pack. Fruit-merchants have no difficulty in selling certain growers' fruit which is often bespoken at the highest ruling price before the fruit is delivered at the market. Buyers desire to obtain these well-graded consignments, while large quantities of fruit badly graded and packed though quoted at a much lower price are stacked in the rooms.

A conscientious packer is one of the most valuable workers in the cycle of duties associated with the assembling of fruit for distribution. If keen, he will readily note any variation in the grade standard of the fruit passed on from the sorters and draw the shed-manager's attention to it. On the other hand, the ultra-fast packer is so absorbed in his record-breaking effort that this precludes the possibility of much attention being given to standards, and, further, neatness and attractiveness also tend to be sacrificed. It must be apparent that only the highest quality in the different standards can effectively command attention to-day, and all adverse factors require to be eliminated.

Regarding the bulge necessary, with thin flexible top and bottom case-timber, fruit is not likely to suffer injury to a serious extent, provided the bulge is built into the pack. This is to say, fruit packed high towards the centre of the case does not suffer, neither does that towards the ends, providing allowance is made in the pack for the latter to press down readily to a level with the end boards. The purpose of the flexible top and bottom boards is to take care satisfactorily of the contents of a case packed in this way. Packers should be instructed to build the bulge in the case during the process of packing, and not simply fill the case with the required number of apples and leave the bulge to the lidding-press and to chance. The process of building in the bulge is quite simple, and may be accomplished by placing one hand on top of the other and pressing into their respective pockets the apples at either end and sides of the case (say, after the second layer has been placed in position), thus causing the pack to " pyramid " or bulge in the centre. This operation takes very little time, and saves considerable loss by bruising and cutting the fruit at either end or side of the case while on the lidding-press.

—*B. G Goodwin, Orchard Instructor, Christchurch.*

Citrus Culture.

Cover-crops : Those who have not yet sown their cover-crops should do so without further delay, so that they may secure the benefit of the good autumn growing-conditions. Much depends upon the weather following the sowing of the seed. In most citrus districts, even if January has been dry, a break in the weather occurs sometime in February, and this, together with the warmth in the soil, gives the cover-crop a good start. For several years the Department of Agriculture supplied cultures for lucerne, and by this means this crop has been successfully grown on ground which otherwise would have proved difficult for its establishment. The Department of Scientific and Industrial Research has decided this year to inaugurate a similar service for the supply of cultures suitable for blue lupins and peas. In view of the success which has attended field trials of these cultures, those who have not had good strikes with these crops in the past may well try inoculation. The cost of inoculum for each 200 lb. of lupin-seed is 2s. 6d. Those desiring to participate in this service should get into touch with the local Instructor in Agriculture at least ten days before they intend to sow the seed.

Picking : Although the crop of a suitable size for picking is light at present, growers should resist the tendency to lengthen the interval between each picking, even though the cost of harvesting becomes greater. The market-values are higher at this time of the year, and every effort should be made not only to participate in the increased prices, but also to keep up the supply of good locally grown lemons so that shortage does not necessitate importation. During the period the picking is light an opportunity should be taken to overhaul the equipment of the picking gangs The clippers should be kept sharpened and should be examined to see that there is no excessive slack between the blades. Picking bags should be repaired if there are any holes which allow fruit to fall out and be damaged. Now that the orchard-boxes are not being used so continuously, time should be found for an overhaul of these also. Protruding nails—a source of many an injury—should be removed, and rough splinters of wood should also be dealt with. In cases where pieces of the bottoms or sides have split and fallen away so that the lemons protrude beyond the bounds of the case or rest on sharp edges, the damaged pieces should be removed and new boards fitted to make the cases again serviceable. The boxes may be strengthened by means of a wire around each end tightly applied and made secure by means of light staples driven in, say, two on each side. One of the wire-tying machines is very serviceable for this job. The cases should be disinfected from time to time, a suitable dip being a 40 per cent formalin solution used at a strength of 1 part by volume to 120 parts of water. While this can be most conveniently done at a central curing-shed, growers should make a point of seeing that this treatment of the boxes is not neglected Instances have not infrequently occurred in which boxes arrive back at the orchard containing one or two blue or green mould-infected fruit firmly attached to the inside of a case Obviously growers placing fruit in cases in this condition do not fully realize the necessity for orchard sanitation.

Manuring · The question of autumn manuring of citrus trees is one about which there has been considerable controversy, but space does not permit a review of the position, nor would this serve any useful purpose. Many of the approved manures for citrus trees are of slow action. Because of this, a number of successful growers make only one annual dressing of fertilizers, generally in the spring. The best position is one in which there is an ample supply of fertilizers in the soil which can be drawn upon by the trees as required and when soil conditions permit. The annual dressing of manures should be looked upon as a replacement of what the trees have taken from the soil during the previous year. If the quickly acting forms of nitrogen, such as sulphate of ammonia and nitrate of soda, are used, it is desirable to make two applications annually, one in early spring and the other in early autumn—February–March—no later. Some growers contend that the application of nitrogen in the autumn is often the cause of frost damage, owing to the fact that the trees produce sappy growth which has not had time to harden off before the advent of frost While there may be some ground for this contention, a point which is often overlooked is that if good growing-conditions continue late into the autumn and then a change to winter temperatures comes suddenly, damage occurs irrespective of manuring.

Disease Control · The February - March period is one in which sprays usually should be applied. Scale insects, where present, require attention according to the programme (summer-oil 1–33) outlined in December notes. The work should be done thoroughly. On inspection immediately after spraying, a tree should show no dry spots on trunk, limbs, fruit, or foliage.

The temperatures during February and March still are favourable for the spread and development of verrucosis, provided other conditions are suitable. Where there is a further blossoming and setting of young fruit, an application of Bordeaux 3–4–50 should be made.

Budding may be carried out now, if desired, provided there is sufficient sap flowing to cause the bark to lift easily. If conditions are suitable, the buds take readily, but growth is not made until the spring. Autumn buds develop ahead of those worked in the following spring.

A. R. Grainger, Orchard Instructor, Tauranga.

POULTRY-KEEPING.

Systematic Culling.

As to cull means to separate anything from the rest because of inferiority the importance of the work or art of culling to the poultry-keeper cannot be overestimated The process may be said to be a continuous one with the successful man It commences when eggs are being set, and is continued with his birds throughout the year. To start with, only eggs of a good size, shape, colour, and texture of shell should be set. In this connection it may be mentioned that three times each year a certain number of the eggs laid by each bird competing at our local laying competitions are judged by officers of this Department for shape, colour, size, and texture of shell, and prizes are awarded accordingly. Though some owners take a keen interest in these judgings, results seem to indicate that many breeders fail to appreciate the importance of this matter.

If a comparison was made each year of the points awarded for size of eggs and texture of shells, it should serve as a very useful guide as to how the vitality and constitution of one's strain is being maintained. If smaller eggs are being produced and less points are gradually being awarded for texture of shell, it should be taken as a warning that the body is gradually getting worn out, and steps should be taken to correct matters. It must be remembered that the hen is not a machine, so when nature sends out these first distress signals every breeder would be wise if he took them as warnings that the exertion and drain of sustained and forced egg-production has been carried far enough, that greater care is needed in the selection of breeding-stock, and that some fresh blood is required.

A person desiring to purchase a bird or birds from a laying competition would be well advised to ascertain the number of points awarded to their eggs, especially for size and texture of shell.

When chickens are hatched, only those showing strength and vitality should be placed under the brooders, while it is better to destroy those showing any weakness.

As the young stock grow those showing want of constitution, poor development, or any deformity should be eliminated. Where such a systematic culling is practised it will be found, in some cases, that when it comes to the end of the first laying-season up to one-third or even more of the pullets hatched have been culled, but the poultry-keeper who adopts such a system gets the very best return from his plant, and maintains a good strong vigorous flock which is seldom attacked with any epidemic or outbreak of disease. There are, however, many poultry-keepers who fail to see the necessity for such hard culling, and some who from want of better knowledge or perhaps lack of interest in their poultry do not practice culling.

It is the desire of the Department to assist poultry-keepers in keeping up the quality of their birds, and if those requiring advice make application to the Department arrangements will be made, if possible, for an officer to visit their farms and give a demonstration. Undoubtedly the best way to keep a flock on a good paying basis is to adopt a regular system of culling throughout the twelve months, but, if this is not convenient, at least once a year a really systematic handling and examination of all birds should take place, and about the best time to do this work is during February, or just before many good birds go into the moult

In order to make the best job of culling a flock the operator must know something about the birds he is to handle, in order that certain points may be given due consideration For instance, if birds have been recently moved from other pens, underfed, or mismanaged in any way, one must be very careful in applying the usual culling-tests.

The age of the birds should be known, and much more satisfactory work is likely to be done when the one-and-a-half-year-old birds are kept in different pens from those of the older birds, but, where this is not possible, the different ages should be marked so that the younger birds can be dealt with first.

Generally speaking, one-and-a-half-year-old hens that began to lay last February or March will not lay as late into this autumn as the older birds that did not start laying until July or August last

The usual matters to take into consideration when a flock is to be culled are- First, the early moulter, for, as a rule, the first birds of a given age to moult are those of weaker constitution and should be culled. If one has plenty of room to accommodate the stock it is generally safe to say that any one-and-a-half-year-old hens that are still laying and have not started to moult by the middle of February will pay to keep for a further year Exceptionally heavy hens for the breed they represent are usually poor producers, and can with safety be put out Birds showing want of vigour and vitality should be culled, and as physical activity is one of the chief characteristics of health it may be said that sluggish birds and those that spend a great deal of their time on the perches are of poor vitality, and should be discarded, together with those very light and poor in condition.

Age to keep.

A great number of hens are kept long after the age when they have the physical ability to produce sufficient eggs to pay for their upkeep This is more noticeable amongst many farm flocks and where poultry are kept, but where there is a lack of interest taken in the birds

Most hens when they reach the age of about two and a half years have come to the time when they are no longer profitable commercial egg-producers, and therefore should be sold However, if the poultry-keeper is breeding his own stock and some of the two-and-a-half-year-old hens are of exceptional breed type and still show vitality, they should most certainly be retained and specially marked for the breeding pen, for experience has shown that such hens are amongst the most valuable breeders.

As there is no way of definitely telling the age of a hen, all birds should be leg-banded If all pullets were leg-banded, say, on the left leg just before they come on to lay, and if a second ring was placed on the right leg at the end of the first laying-season, there would be no difficulty in picking out the different ages and culling them when their term of usefulness has ended.

The Late-hatched Pullets.

Although the loss occasioned from keeping hens that have passed the age of usefulness is very considerable, it is safe to say that the greatest weakness in the industry to-day is the hatching of late stock and the lack of proper culling of growing pullets. It is true that to be able to cull successfully a flock of healthy growing pullets calls for extra skill and experience, but on many farms no young stock are culled until the autumn of the year, with the result that many weedy pullets that never pay their way and are a danger on the plant are kept. Pullets hatched much after the end of October seldom start laying until well into the winter, or until early spring, and as eggs are then getting cheap such late stock have not sufficient time before the moulting-period begins in February or March to produce enough eggs to repay what they have cost.

It is safe to say that it pays well to cull up to 10 per cent. of well-reared pullets before they start laying, but with poorly reared, weedy, or late pullets the culling should be much harder.

Body Type.

A bird to be a good layer must have a well-balanced body showing ample capacity, which is estimated by the distance from the pelvic bones to the end of the breast bones, and also by the length and width of back--in other words, by the cubical content of the body frame.

The chief characteristics of a cull are—Abdomen small and tucked up, but if large it feels coarse with layers of fat underneath the skin. The comb is usually small, more or less hard, and cold. Head coarse or small and weedy; eyes small, listless, and sunken. The pelvic bones are usually thick, coarse, and stiff, with less than two fingers' width apart. Vent dry, small, and puckered.

Over-fat Leghorns or other yellow-legged breeds can usually be picked out by their yellow legs and beaks at this time of year. The continuous striving for increased egg-production is likely to cost the industry dearly unless every effort is made to maintain vigour and constitution; even to-day some poultry-keepers are finding that financial success depends largely upon their being able to combat disease. No producer can afford to overlook or underestimate the best means of protection, which is to master the art of and adopt systematic culling throughout the year.

C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Final Extracting.

BEFORE the last of the surplus honey is taken a careful examination of the colonies should be made in order to ascertain the amount of stores available for wintering the bees. Too often beekeepers err in extracting too completely, and feeding has to be resorted to at a later period to make up the amount required to prevent starvation It takes 30 lb. of honey to winter a colony successfully, and if this amount is increased to 40 lb. there is less likelihood of the bees being short in the spring, while the beekeepers also are saved a great deal of anxiety and endless trouble in the way of feeding.

Where extracting has been delayed for any reason, it is advisable to use great caution in removing the honey. The combs should be removed as expeditiously as possible, and care should be exercised not to incite the bees to rob by keeping the hives open longer than it is necessary to remove the surplus. A hasty examination of the brood-chamber should be made if it is found that the bees have not filled the combs in the lower story with honey. If empty or partly filled combs are found, it is highly important that they be replaced with good combs of honey from the super. On no account attempt to extract any honey from the brood-chamber Do not leave combs lying about or expose vessels that have contained honey. Unless caution is exercised in regard to these details, when the final extracting is being done the beekeeper is more than likely to start the bees robbing in a wholesale manner.

Bee-escapes.

For removing honey late in the season the beekeeper may find it necessary to bring into use bee-escapes. These escapes enable the honey to be removed without causing any disturbance. By the employment of the Porter bee-escape there is less likelihood of causing robbing, with its attendant evils. More especially are the escapes found advantageous when removing section honey from the hive. There is far more risk in removing comb-honey than extracted honey. When the colony is disturbed the bees at once start to fill their sacs, and often the cappings of the sections are punctured in order to secure a supply of honey. The damage to the cappings of sections is unsightly, and causes the honey to "leak" after removal from the hive. The escapes are fitted to a board of the exact dimensions of the hive in use. In inserting the board gently prize up the super from the brood-chamber and insert the board. A puff of smoke suffices to control the bees while the operation is being performed. If this is done late in the afternoon the bees pass through the escape during the night to the brood-nest, and are unable to return. In the morning the supers may be removed, when practically no bees will be left in the super.

A word of caution to those who formerly have not used the escapes: Should there be brood in the super-combs, the bees do not leave, and the escapes do not prove effective in ridding the supers. Over and over again many beginners complain that they cannot get the bees to leave the supers when using escapes, but the reason lies in the fact that no examination had been made to ascertain beforehand whether the super contained honey only.

Uniting Colonies.

In the autumn, work requiring attention is the examination of the colonies for the purpose of ascertaining if each possesses a laying queen, and of noting those that are too weak to survive the winter. It is advisable to unite a weak colony or one without a queen with a stronger colony to save the bees. On no account should an attempt be made to winter weak hives, as they are likely to get robbed, and this may cause the bees to start robbing when everything in the apiary should be quiet A simple method of uniting may be practised by placing the weaker hive on top of a stronger one, and placing a sheet of newspaper between the two hive-bodies. In the course of a few days the bees of the weaker colony make their way through the paper and unite peaceably with the bees in the stronger hive The surplus combs may subsequently be removed and reserved for spring feeding if required It is advantageous to destroy the queen in the weak hive prior to uniting

Robbing.

At the close of the honey-flow the beekeeper should guard persistently against robbing. Robbing, the result of carelessness, once started is exceedingly hard to check. As previously mentioned, neither honey, sugar-syrup, nor anything that the bees can take should be exposed If wet combs have to be returned to the hives for the bees to clean, postpone this operation until late in the day, when robbing is not likely to start. See that the honey-house is bee-proof, and that all combs and vessels containing honey are removed to a place of safety. Contract all hive-entrances, and especially guard against hives being open in a way that they can be attacked by robbers. All operations must be carried out quickly If robbing has started it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the entrance and pile wet grass in front of the hive. This usually cures mild cases of robbing, but where a colony has been overpowered by the robbers it should be closed altogether.

E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

The full enjoyment and economical use of many vegetables depend not only on a wise selection of varieties and careful culture; sound consideration must be given to harvesting and storage if there is to be no loss in quantity and quality and the stocks are to be available over a maximum period. Under most local conditions such crops as celery, parsnips, salsify, artichokes, autumn-sown carrots, and beet may be left in the ground during winter, with quite satisfactory results, and lifted in dry weather as required until about the month of August, when growth is about to recommence. They must then be lifted and stored where the conditions are cold, well ventilated, and not too dry. Main-crop carrots maturing about the month of April split if left in the ground, and become coarse and fibrous, as do main-crop beet maturing at that time. These should be lifted in fine weather as soon as they mature and given the storage conditions before mentioned.

A lean-to shed with a southerly aspect often is a suitable place, especially when shaded by plantation trees and having ample means for ventilation in the higher part of the roof. Such a place is also suitable for potatoes stored in bins, sacks, or boxes, if it is clean, well drained, and dark, but not so dry as to cause the tubers to shrivel. Considerable losses from decay occur if the stocks are contaminated by the presence of decayed tubers or waste carried over from a previous season in the store or its vicinity. This can readily be avoided by the methodical disposal of decayed waste at all times, and a thorough annual clean-up of the store, which may very well include a careful spraying of the interior with a reliable fungicide. Losses from decay may also occur through infection caused by decayed tubers overlooked when bagging in the field ; or a good crop, to all appearances sound, may be placed in the store and in a month may be in a useless condition due to the attack of the potato-moth. This attack, which is most likely to occur in warm, dry localities and seasons, may be avoided by picking up and bagging the tubers the same day as they are dug and placing them in a clean store. In this way the night-flying, egg-laying moth is unable to deposit on the tubers those eggs which later hatch out into caterpillar larvae which tunnel the flesh and make tubers an early prey to organisms of decay. Doubtful stocks should be picked over after a month or two in storage, and if the infection is fairly extensive they should be used as soon as possible. Large quantities stacked in a compact manner heat and sprout, especially in warm districts, and in a store where attention to ventilation is neglected. In such localities they may be stored satisfactorily in slatted bins to a depth not exceeding 3 ft. or 4 ft., but in colder districts 6 ft. may be a maximum depth, as long as good ventilation is provided, except when there is danger of injury through frost. Where stocks are large and storage accommodation limited, a quantity for late use may be satisfactorily held in a pit or clamp outside if the tubers are quite sound. For this purpose a well-drained, cool position should be chosen, and the pit made not more than 5 ft. or 6 ft. wide, and the tubers piled as high as possible. To prevent heating the pit should not be completely sealed for the first few weeks ; during that period the soil casing over the straw or fern covering should only be carried up to within a foot of the ridge. If these conditions are observed and the potato crop is carefully dug in fine weather as soon as ripe, and allowed to harden off for a few hours before gathering, it will be used to best advantage.

The onion crop requires somewhat similar storage conditions, the chief difference being a drier atmosphere. The bulbs should be lifted as soon as ripe (this is of especial importance in districts inclined to be humid and warm), placed in windrows consisting of five or six rows of bulbs, until the tops wither completely. If wet weather is experienced the windrows are turned over by the use of a wooden rake. When thoroughly dry the bulbs are trimmed with shears and bagged, or placed in slatted crates, and stacked in an open shed for a few weeks to cure thoroughly before storage or shipping. When cured the bulbs are cleaned by taking away the dry outer scales. Bulbs which have thick necks or which are damaged are removed, and the remainder are graded to size. They will then store satisfactorily if placed in a comparatively dry atmosphere that is cool, with an even temperature and given thorough ventilation at all times, except in wet or humid weather. If in slatted boxes they are stacked, like fruit, with 1 in. space between tiers and rows to permit of circulation of the air ; or they may be spread 6 in. or 8 in. deep on slatted shelves ; or small quantities may be " strung " and hung in a dry airy place in the old-fashioned manner. This latter method is particularly suitable for shallots held over for planting another season. All bulbs of this class deteriorate very quickly in a close atmosphere.

Vegetable marrows are best used in a green state when of a suitable size, but pumpkins, and what are known in America as winter-squash—such as the Hubbard varieties should not be harvested until thoroughly ripe, but before they have been frosted. They are cut with a portion of the stem attached and left in the field to mature before carting They must be handled and carted with care, as it is easy to injure them seriously at this stage. When they are stored in a warm, dry, airy place for a few weeks their shells harden and they then can stand somewhat lower temperatures and rougher handling if that is necessary.

In the warmer districts, especially where there is also a heavy annual rainfall, the ordinary late potato crop is rather difficult, but the sweet potato, or kumara, generally grows well. For this and other reasons it is increasing in popularity in such areas. While the crop is best left growing as late as possible, it must be lifted before there is any frost, or the tubers immediately under the crown are liable to injury. If frost kills the vines the kumaras should be dug immediately, as decay sets in on the dead vines and may pass down to the tubers Digging must be done with the greatest care, as the slightest damage at this stage prevents the tubers keeping, and storage losses are due chiefly to faulty handling before curing. Curing, which occupies about a week, is usually done by gathering the tubers into heaps and covering them with sacks every night, to dry them thoroughly before storage in a warm dry, chamber that can be ventilated in warm weather. Small quantities may be kept successfully by storing in sand provided it is perfectly dry

In the southern States of America, where sweet potatoes are grown on a commercial scale, the tubers are stored in crates, stacked to allow ample ventilation and to enable the air to circulate through them, in chambers that are heated to a temperature of about 80° F. for the first fortnight or so of the storage period When the roots are well dried the temperature is allowed to drop to 55°, and is held there for the rest of the storage period, giving ventilation freely when the weather permits.

To provide young spring onions at that season, when salads are so much in demand, a sowing should be made during the month of March--towards the end in the warmer districts. For this purpose the Rocca or Tripoli types are most suitable, owing to their mild flavour and tender flesh. In warm districts with a considerable annual rainfall the sowing should be extended to also provide young plants for setting out in early spring that ripen their bulbs about the month of January, which is more satisfactory under such conditions than sowing the main crop in early spring as is done in the drier districts. The land selected for the seed-bed should be well drained and thoroughly cleaned of weeds by shallow cultivation for some time before sowing.

Where the tomato crop is of considerable importance it sometimes is advisable to select the seed under local conditions, so that while the fruit is of a type suited to one's requirements the plants are thoroughly acclimatized. Time and careful consideration should be given to the selection of plants from which seed is to be taken ; they should be free from serious disease, of good constitution, and carrying crops that are as satisfactory as possible in regard to quantity and quality. Fruit that is likely to be coarse or small should be removed from the bunches and the remainder allowed to ripen naturally on the plants, which should be flagged to enable them to be readily recognized. When the tomatoes are ripe they should be cut open and the pulp dropped into a little water. The water containing this pulp should be placed in a warm place, and as soon as it commences to ferment it should be poured into a gravy-strainer and washed well under a tap of running water until clean seed only remains. The clean seed should be placed in a position where it dries quickly and well stirred frequently to prevent seeds sticking together. If the seed is stored in tins or other air-tight containers, it is as well to redry it after a short period to make sure of its condition. It should then remain in good condition for five years at least. When conditions are favourable for a good seed-harvest a generous supply should be taken to provide against contingencies. Another method of saving tomato-seed is to scoop the seeds from the fruit and let it drop on to sand that is quite dry and has been passed through a fine sieve; the mixture should be well rubbed through the hands for some time and then spread to dry. When it is dry it should be rubbed again and sieved to remove the sand.

The Homestead Garden.

Where trees and shrubs for shelter or ornamental purposes are to be purchased a visit to the nurseries should now be made and the requirements carefully selected and ordered for delivery so soon as they are ready for removal, which will generally be towards the end of the month of May. They can then be planted at once with great advantage or they can be "heeled in" and so be ready for planting whenever the weather and other circumstances permit.

Most kinds of spring flowering bulbs are planted during the first four months of the new year, but the earlier this is done the better, so that they may be well rooted before winter sets in. Exceptions are hyacinths and tulips, which appreciate a period of warm storage, also anemones and ranunculus tubers; these are usually planted during the month of April, and are all partial to a soil well supplied with lime. Many plants of this class provide an early display of blossom of excellent quality with little labour, and so deserve every consideration. In addition to high culture in special beds, they may be planted in grass or shrubberies, where they will flourish for many years before requiring attention.

Established lawns may now be given any extra attention that is necessary, such as returfing worn places and loosening up hard places with a fork, or thoroughly raking the whole area, and, after cutting, sowing suitable grass-seeds before applying a light top-dressing composed of fine soil and manures. Where the lawns have, been in constant use for games this attention is urgently needed, and should be commenced as soon as the playing-season is finished, so that the most may be made of the interval between seasons which is generally all too short for this purpose. A sharp look-out should be kept for insect pests. This is the season when damage may be done to lawns by the common earthworm when numerous, or the subterranean caterpillar (*Porina*) or grass-grub (*Odontria zealandica*). Damage is best avoided by giving the matter prompt attention so soon as the attack is perceived.

—*W. C. Hyde, Horticulturist, Wellington.*

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ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FOOT TROUBLE IN DRAUGHT HORSES.

W. L. B., Waipara :—

A complaint that the draught horses have in their hooves here appears to be similar to thrush , the feet have a septic discharge, sometimes from the cleft of the frog, and sometimes from the depressions at each side of the frog, and the discharge has an offensive smell The complaint develops in front or back feet, and it recurs every three months or so.

The Live-stock Division :—

The symptoms you have described are caused by an inflamed condition of the membrane, which secretes the horn of the frog. Under these conditions this membrane forms weak and degraded horn of a cheese-like consistency, which readily liquifies under the action of moisture and produces the offensive discharge For treatment you must first endeavour to keep the feet dry. Carefully remove any diseased or loose portions of the horn, then thoroughly work into the parts from which the discharge issues one of the following applications (1) burnt alum, or (2) calomel, or (3) iodoform 1 part, eucalyptus oil 8 parts If you wish to keep the horse at work the dressing should be packed in with cotton wool or tow, over which is smeared Stockholm tar in order to keep out the wet and dirt Unless the discharge is profuse, the dressing may be left in place for two or three days

CROP FOR LAND INFESTED WITH YARR.

F. M. R., Springfield :—

A paddock which was sown in turnips, partly owing to the wet season, was an almost complete failure, a weed which we know as yarr taking possession and going to seed It is now proposed to lime the land with ½ ton of carbonate of lime per acre, and sow a smothering-crop to be later cut for silage. Would you suggest the most suitable crop to grow, the rainfall is 40 in , and we are 1,000 ft above sea-level

The Fields Division :—

A satisfactory result may be expected from sowing a mixture consisting of 2 bushels of oats and 1 bushel of Partridge peas or Scotch tares Garton's and Algerian oats are both suitable for the purpose, but if a late spring sowing is anticipated the Garton variety, a rapid upright grower, is likely to be preferable. With quantities of 3 bushels per acre of the mixture suggested it is often an advantage to drill and cross drill the seed - that is to say, sow 1½ bushels each way, and 1 cwt. to 1½ cwt of superphosphate per acre can usually be applied with profit to such crops

KEEPING-QUALITY OF SPRAYING MATERIALS.

T. W., Otekaike :—

How long will the following materials keep without detriment : Bluestone in solution, lime in solution, Bordeaux mixture in solution, lime sulphur in solution, and most mixtures for stone and pip fruits.

The Horticulture Division :—

Stock solutions of bluestone and lime may be stored separately for long periods without deterioration. Other solutions and mixtures of orchard-spraying materials depreciate in various ways, some very quickly. They should be used the same day, and, better still, applied as soon as made, with the agitator working to keep all ingredients in suspension and thoroughly mixed, especially where large quantities are being used.

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 3rd December, 1936, to 28th January, 1937, include the following of agricultural interest :—

No. 75460 : Sleigh ; C. J. Honore. No. 76205 ; Threshing-apparatus ; Allis-Chambers Mfg. Co. No. 76939 : Teat-cup ; L. A. Sowerby. No. 74596 : Rabbit-poisoning ; K. G. McEwan. No. 74683 : Pump ; F. A. Stempa. No. 74886 : Casein product ; Albright and Wilson, Ltd. No. 75386 : Fruit-picking bag ; S. R. and A. R. F. Fisher. No. 75453 : Plough-share ; A. B. MacDonald. No. 75578 : Teat-cup ; A. J. Chinn. No. 75703 : Milking-machine ; L. R. and T. W. Greenslade. No. 76141 : Insecticide ; Assignees of S. C. Fulton. No. 76204 : Harvester-thresher ; Allis-Chambers Mfg. Co. No. 76214 : Manure-distributor ; J. H. Nitschke. No. 76947 : Shear-head ; Wolseley Sheep-shearing Machine Co., Ltd. No. 77014 : Fencing, barbed-wire ; H. A. Abbott. No. 77057 : Manure-distributor feeding-slot ; J. H. Nitschke. No. 74822 : Fencing-post clip ; W. Laird, H. M. Carruthers, and D. McL. Lewis. No. 75801 : Lawn-mower ; J. W. Johnson.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid

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WEATHER RECORDS: JANUARY, 1937.

Dominion Meteorological Office.

NOTES FOR JANUARY.

THOUGH the rainfall was below normal in parts of the South Island, the weather was generally humid, and January was a wet month, especially in the North Island. The humid conditions favoured the growth of pasture, which is still abundant, in many places indeed superabundant. Stock, consequently, are in good condition, and the milk-yield has been well maintained. Feed remains rather soft, however, and lambs have not fattened very well. The cool weather, too, has been rather unfavourable for crops of most kinds. Shearing, which had been held over in some districts by the wet weather, was still further delayed, and haymaking was interfered with. White butterflies have been rather more numerous again. Unusually low pressures prevailed throughout the month, which was more stormy and windy than most Januaries.

Rainfall.—The whole of the North Island, with the exception of parts of Taranaki, had more than the average rainfall. North Auckland had more than double, and between Hawke's Bay and the Bay of Plenty, also, it was very wet. In the South Island, though it was generally a wet month, the total falls were below normal in Nelson and parts of North Canterbury and Otago.

Temperatures were below normal over almost the whole country, the departure being generally about 2° F. Hastings and Hanmer Springs, however, were warmer than usual, doubtless owing to the Föhn effect in the strong westerly winds About the middle of the month a few frosts were recorded, and snow fell to rather low levels on the mountains.

Sunshine was above normal at Wellington and in eastern districts of the South Island, but elsewhere was below it. Blenheim had 277·2 hours, Lake Tekapo 272·7, and Nelson 255·2.

Pressure Systems.—On the 1st a depression was passing away eastward, and the weather was still disturbed over the Dominion. Rain was widespread. Some heavy falls occurred on both coasts of the North Island, but particularly in the north-east.

On the 5th a vigorous disturbance came from the Tasman Sea, and a centre of low pressure moved from west of the Auckland Peninsula south-south-easterly across the North Island. Heavy rain was general.

Between the 9th and the 12th there was a series of westerly depressions which affected principally the South Island and southern portions of the North.

On the 14th a cyclonic depression, which had developed in the North Tasman Sea, moved southwards from near Norfolk Island across the North Island and finally filled up on the 16th. On the 14th to 15th easterly gales in the Auckland Province did considerable damage. Heavy rain was again general over the North Island, and some flooding occurred in North Auckland and southern Hawke's Bay. Dannevirke had 8·25 in. of rain on the 16th.

After a brief interval of anticyclonic weather, a series of very deep westerly depressions crossed the South Island between the 19th and 23rd. In the south the barometer fell below 29 in. Westerly gales were experienced in many places, and heavy rain fell in the west and south.

The last storm of the month began as a tropical cyclone in the northern New Hebrides and passed, a week later, in a south-easterly direction down the east coast of the Auckland Peninsula on the 29th and 30th. Strong easterly winds and heavy rain occurred in eastern and northern parts of the North Island. At the same time, a westerly depression passing in the south brought heavy rain to the west coast of the South Island.

RAINFALLS FOR JANUARY, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Fall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	8·47	13	1·90	3·94	8·47	3·94
Russell	17·10	13	5·15	4·09	17·10	4·09
Whangarei	10·64	14	4·30	3·93	10·64	3·93
Auckland	4·41	18	1·58	2·97	4·41	2·97
Hamilton	5·28	16	1·61	3·57	5·28	3·57
Rotorua	..	..	..	4·18	..	4·18
Kawhia	..	..	..	3·55	..	3·55
New Plymouth	4·24	14	1·04	4·18	4·24	4·18
Riversdale, Inglewood	7·97	14	1·56	7·51	7·97	7·51
Whangamomona	5·20	11	1·57	5·58	5·20	5·58
Hawera	3·08	15	1·09	3·51	3·08	3·51
Tairua	..	..	..	3·66	..	3·66
Tauranga	5·38	17	1·67	4·03	5·38	4·03
Marachako Station, Opotiki	10·43	10	4·70	3·59	10·43	3·59
Gisborne	5·15	10	1·67	2·72	5·15	2·72
Taupo	4·62	10	1·61	3·37	4·62	3·37
Napier	4·69	14	2·18	2·50	4·69	2·50
Hastings	3·01	12	1·75	1·93	3·01	1·93
Whakarara Station	6·29	9	1·20	..	6·29	..
Taihape	4·21	22	1·25	3·18	4·21	3·16
Masterton	4·14	12	1·65	2·56	4·14	2·56
Patea	4·07	17	0·87	3·59	4·07	3·59
Wanganui	3·23	11	1·30	2·83	3·23	2·83
Foxton	2·24	11	0·73	2·14	2·24	2·14
Wellington	3·18	12	1·26	2·89	3·18	2·89
South Island						
Westport	8·93	18	2·07	8·20	8·93	8·20
Greymouth	15·30	22	4·01	9·17	15·30	9·17
Hokitika	14·36	20	4·38	10·10	14·36	10·10
Ross	20·49	18	4·99	12·40	20·49	12·40
Arthurs Pass	20·25	17	3·71	14·12	20·25	14·12
Okuru, South Westland	14·52	10	3·00	12·59	14·52	12·59
Collingwood	9·43	17	2·96	6·71	9·43	6·71
Nelson	2·09	7	1·32	2·90	2·09	2·90
Spring Creek, Blenheim	3·65	9	2·00	2·22	3·65	6·22
Seddon	3·59	9	1·76	1·84	3·59	1·84
Hanmer Springs	2·14	15	0·36	3·95	2·14	3·95
Highfield, Waiau	1·09	8	0·29	2·98	1·09	2·98
Gore Bay	1·30	12	0·23	2·46	1·30	2·46
Christchurch	2·08	..	0·71	2·33	2·08	2·33
Timaru	3·70	10	1·20	2·39	3·70	2·39
Lambrook Station, Fairlie	3·48	11	0·81	2·43	3·48	2·43
Benmore Station, Clearburn	5·50	11	2·06	2·77	5·50	2·77
Oamaru	2·27	10	1·28	2·04	2·27	2·04
Queenstown	3·86	12	0·80	2·87	3·86	2·87
Clyde	1·60	10	0·49	1·85	1·60	1·85
Dunedin	3·31	16	0·96	3·41	3·31	3·41
Wendon	4·90	12	2·10	3·20	4·90	3·20
Balclutha	2·35	14	0·70	2·31	2·35	2·31
Invercargill	4·38	22	0·60	4·00	4·38	4·00
Puysegur Point	7·89	20	1·07	7·62	7·89	7·62
Half-moon Bay	7·21	20	1·15	4·82	7·21	4·82

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PEA-MOSAIC.

ITS SYMPTOMS, ECONOMIC SIGNIFICANCE, AND PREVENTIVE TREATMENT.

E. E. CHAMBERLAIN, Plant Diseases Division, Plant Research Bureau, Palmerston North

OF the many virus diseases which have been recognized in New Zealand during the past few years pea-mosaic is one of the most common This disease occurs throughout both North and South Islands, and its incidence appears to be increasing. It is of world-wide distribution, having been recorded from Europe, North America, South America, and Japan.

HOST-RANGE.

The host-range of pea-mosaic in New Zealand has already been discussed (Chamberlain, 1936) It occurs in the field on garden and field peas, blue lupins, red clover, broad beans, and sweet peas.

SYMPTOMS.

Garden Peas (Green Feast variety)—The first symptom of the disease occurs on the young leaves, where the appearance of light-coloured areas along the veins produces a net-work type of mottling (Fig. 1B). Later symptoms consist of a more generalized mottling (Fig. 1A). In some varieties, such as Yorkshire Hero, the mottling may become much more pronounced, the light and dark green areas being larger than those on Green Feast and the leaves distorted (Fig. 2). Infected plants are stunted (Fig. 3) and usually paler in colour than healthy plants. They flower later and produce fewer pods, which are smaller, less well filled, and mature more slowly than those of healthy plants (Fig. 4).

In certain late varieties of luxuriant growth the internodes are considerably shortened, thus producing a more marked stunting of the plants.

The symptoms on field peas are similar to those on garden peas.

Blue Lupins.—The symptoms on this host have been given in detail elsewhere (Neill, Brien, and Chamberlain, 1934). In brief, they are: Curling-over of the growing-point, cessation of growth, browning of the stem, wilting of the young leaves, and, finally, death of the plant.

Red Clover.—The characteristic symptom is a mottling of the leaves. This mottling is produced by the occurrence of light-coloured streaks which follow the direction of the veins (Fig. 5). Infected plants are pale in colour and often much stunted (Fig. 6).

Broad Beans (Exhibition Long Pod variety).—As with peas, the first symptom is the appearance of light-coloured areas along the veins of the young leaves, these being replaced later by a more general type of mottling (Fig. 7). Infected plants are stunted and are paler in colour than healthy plants. The pods do not set freely and are small in size, with the result that the yield is considerably reduced.

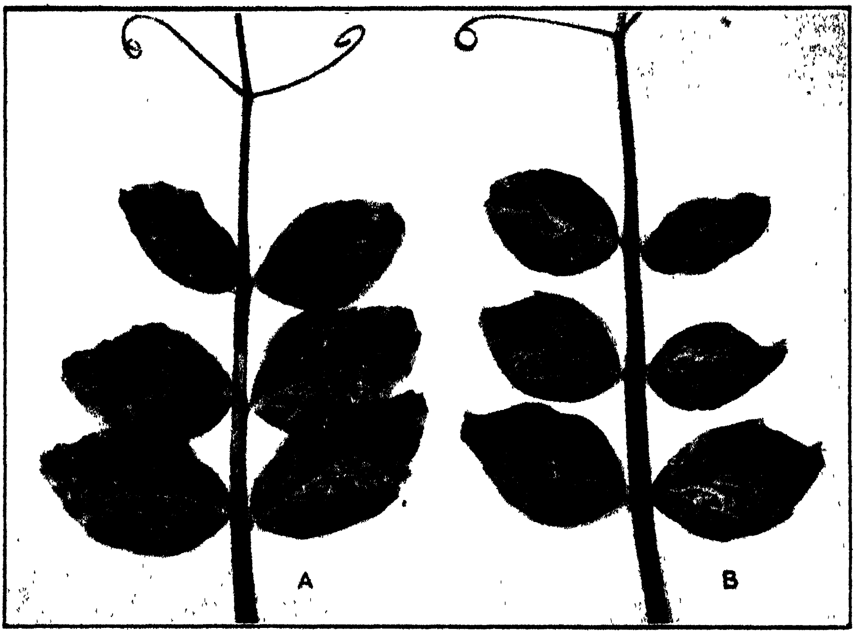

FIG. 1. PEA-MOSAIC. LEAVES FROM INFECTED GREEN FEAST GARDEN PEAS.

A. Showing ordinary mosaic mottling. B. Showing early symptoms of the disease.

[Photo by H. Drake.

Sweet Peas.—Here again the characteristic symptom is a mottling of the leaves (Fig. 8). Neither the growth of the plant nor the number of flowers produced appears to be greatly affected. The flowers show, however, a definite streaking (Fig. 9), similar in nature to "breaking" in tulips.

INCIDENCE.

Peas.—Although the occurrence of mosaic on peas is general throughout New Zealand, it has become of economic significance only in certain localities. Of these, the seed-growing district of Marlborough is the most important. An inspection during the last season of a number of crops in the vicinity of Blenheim showed that (with the exception of certain apparently immune varieties) a high percentage of mosaic occurred on both garden and field peas. In every crop examined infection was greater near the outside of the field than in the centre. Thus some crops showed an infection of approximately 20 per cent. near the headlands and as low as 5 per cent. in the centre of the crop, while others showed approximately 50 per cent. near the outside and 15 per cent. in the centre.

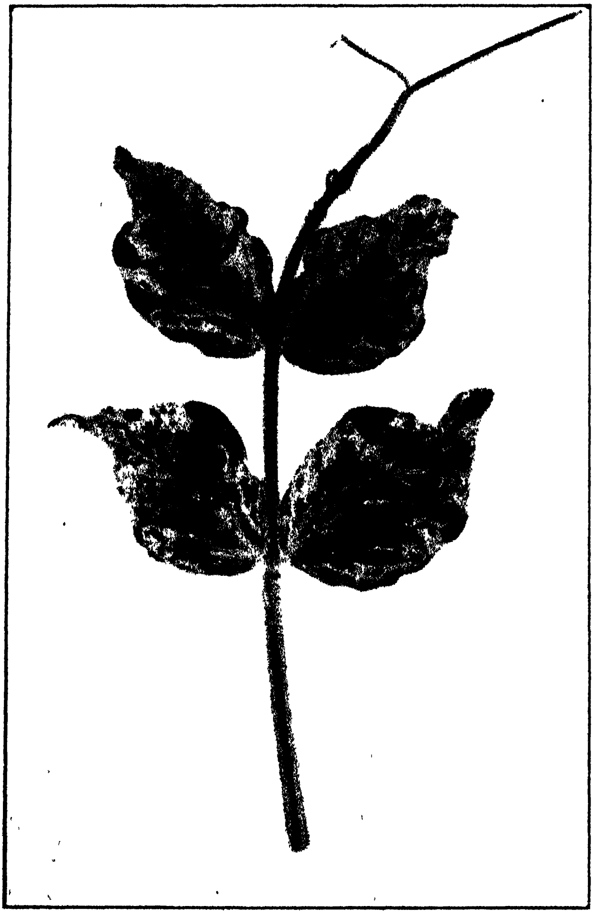

FIG. 2. PEA-MOSAIC. PRONOUNCED MOTTLING OF LEAF OF YORKSHIRE HERO GARDEN PEA.

[*Photo by H. Drake.*

In the Manawatu district pea crops occasionally become severely infected, and small areas have shown an infection as high as 90 per cent.

Blue Lupins.—The incidence of the disease appears to be even greater on blue lupins than on peas. Its economic significance has been dealt with already (discussed under the name of "sore-shin"—Neill, Brien, and Chamberlain, 1934).

Red Clover.—Under ordinary cultivation red-clover crops do not appear to develop a high percentage of infection. Thus in crops near Blenheim it was difficult to find infected plants. Along the headlands and roadsides, however, the percentage infection was much higher, and the plants along three to four miles of roadside inspected showed approximately 20-per-cent. infection.

At the Plant Research Bureau, Palmerston North, mosaic on single-plant selections has caused a great deal of trouble to the agrostologists. Single plants over a period of two seasons become infected to the extent of almost 100 per cent.

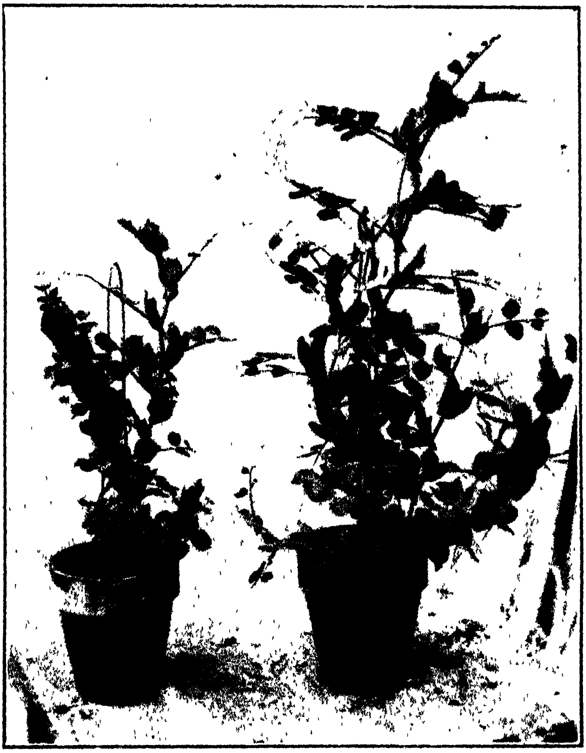

FIG. 3. STUNTING CAUSED BY PEA-MOSAIC ON GREEN FEAST GARDEN PEAS, GROWN IN THE GLASSHOUSE HEALTHY PLANTS ON RIGHT

[*Photo by H. Drake.*

Broad Beans and *sweet peas* are commonly infected, but the disease is scarcely of economic significance on the latter.

EFFECT ON YIELD OF GARDEN PEAS.

Some idea of the effect of pea-mosaic on yield may be obtained from Fig. 4. Several attempts to determine the actual reduction in yield have failed, because in each case the disease spread to the check plants.

During the 1935-36 season a small-scale yield trial was obtained by marking, in a block showing a small percentage of the disease, each mosaic-infected plant, together with a healthy plant adjacent to it. These plants were harvested separately and the weight of seed taken. The results are given in Table I.

Table I.—Effect of Pea-mosaic on Yield of Garden Peas (Yorkshire Hero Variety).

Plant No.	Weight of Seed.	
	Healthy	Mosaic infected.
	Grammes.	Grammes
1 .. .	10·05	3·89
2	12·40	3·72
3	7·42	4·52
4	10·83	6·84
5 ..	11·97	3·32
6 ..	14·84	4·94
7	9·85	7·95
8	3·15	4·10
9 .. .	8·11	4·63
10	7·50	4·32
11	10·15	7·51
12	8·36	4·22
Total ..	114·63	59·96

The reduction in yield amounted to 47·7 per cent.

The crop was poor owing to unfavourable weather conditions, and the yield from individual plants was further lessened by close planting.

METHODS OF SPREAD AND OVERWINTERING.

It has already been shown (Chamberlain, 1936) that pea-mosaic may be transmitted by artificial inoculation with expressed juice. Such transmission, however, is difficult to secure, and it is improbable that the disease would be spread by handling the crop.

Pea-mosaic is readily transmitted by means of insects. In this country it has been found that the aphides *Myzus persicae*, *Aphis rumicis*, and *Macrosiphum gei* are able to transmit the disease (Chamberlain, 1936). All three aphides occur commonly on peas.

In New Zealand no transmission of pea-mosaic has been secured through the seed of peas, blue lupins, red clover, or broad beans (Chamberlain, 1936).

Thus it would appear that under natural conditions spread is effected by insects. Since peas, blue lupins, broad beans, and sweet peas are all annuals initial infection must take place from some outside source, and the most obvious source is red clover.

In the United States of America Davis (1915) found that the pea-aphis (*Macrosiphum pisi*) overwintered on red clover and migrated to other legumes in the spring and summer. In New Zealand *Myzus persicae* and *Macrosiphum gei* infest red clover, and it would appear that they overwinter on this host. Any of these aphides which have overwintered on mosaic-infected red clover would carry infection with them when they migrated to other legumes in the spring or summer. That such occurs is suggested by observations made at the Plant Research Bureau.

All plantings of red clover made at the Bureau Area within the last five years have developed a high percentage of mosaic, and all crops of garden peas, blue lupins, or broad beans grown in their vicinity (within 4 chains) have become severely infected with the disease. In the spring of 1934 Green Feast garden peas and blue lupins planted within 1 chain of a block of mosaic-infected red-clover plants developed 89·5 and 93 per cent. of the disease respectively. Green Feast peas grown on another portion of the farm (over 10 chains distance) developed approximately 0·25 per cent. mosaic, and blue lupins grown at a similar distance from the red clover showed an infection of about the same order.

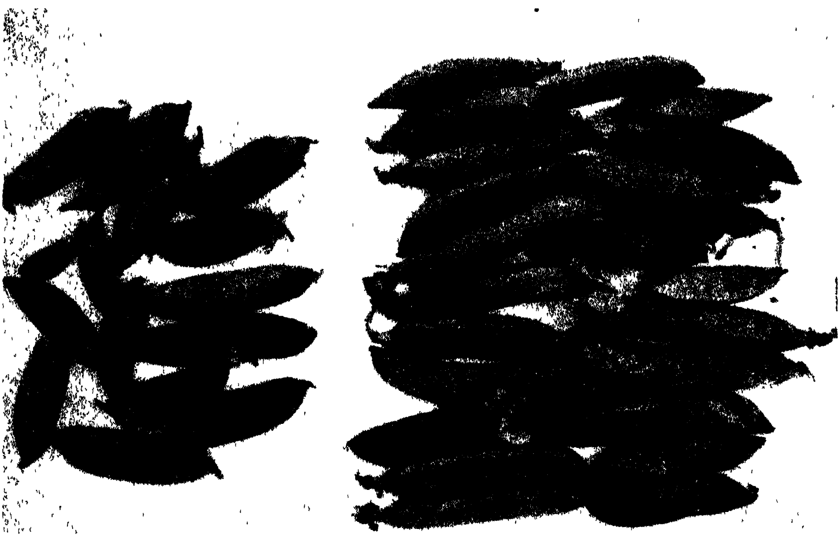

FIG. 4. EFFECT OF PEA-MOSAIC ON YIELD OF GREEN FEAST GARDEN PEAS

The pods on the left are the yield of a single infected plant, while those on the right are from a single healthy plant.

[*Photo by H. Drake*

In Marlborough it appears that the disease spreads to the pea crops from infected red-clover plants growing along the headlands and roadsides.

IMMUNE VARIETIES.

During the spring of 1933 a block of ten varieties of garden peas were grown at the Plant Research Bureau. The varieties grown were Green Feast, Great Crop, Pioneer, Lord Chancellor, Medium Straw Daisy, Gladiator, Admiral Beatty, Pride of the Market, Prince of Wales, and Little Marvel. To ensure development of mosaic, aphides from infected plants were distributed through the crop. All varieties except Lord Chancellor and Little Marvel developed a high percentage of mosaic.

These two varieties were grown the following season adjacent to Green Feast peas in a block within 1 chain of an area of mosaic-infected red clover. Of the 525 plants of Green Feast peas grown 89·5 per cent. developed mosaic, while the 349 Lord Chancellor and the 578 Little Marvel plants remained healthy.

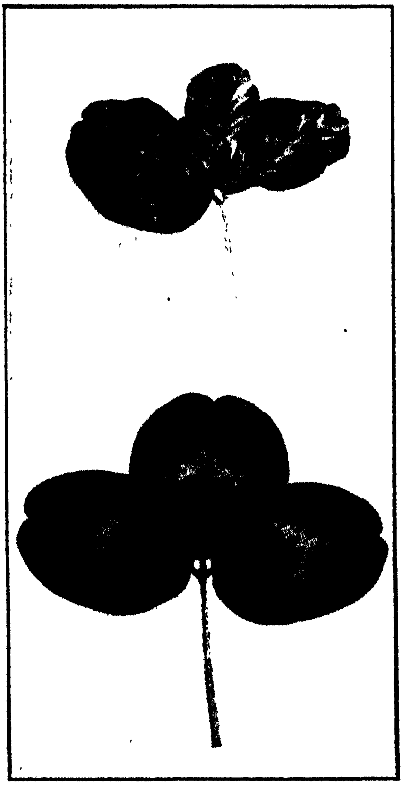

FIG. 5. THE EFFECT OF PEA-MOSAIC ON THE LEAVES OF RED CLOVER LEAF FROM HEALTHY PLANT AT BOTTOM.
[*Photo by H. Drake*

The immunity of these two varieties was also tested in the glasshouse, where an attempt was made under controlled conditions to transmit mosaic to them by means of aphides. The results of these experiments are given in Table II.

Table II.—Determination of Varietal Immunity of Peas to Pea-mosaic.

Date of Inoculation.	Variety.	Species of Aphis	Number of Aphides	Number of Plants inoculated.	Number of Plants infected.
25th January, 1935..	Green Feast ..	*Aphis rumicis*	12	15	5
,, ..	Lord Chancellor	,,	12	15	0
,, ..	Little Marvel ..	,,	12	15	0
11th March, 1935 ..	Green Feast ..	,,	10	20	11
,, ..	Lord Chancellor	,,	10	20	0
,, ..	Little Marvel ..	,,	10	20	0

Both field and glasshouse experiments indicate that Lord Chancellor and Little Marvel peas are either immune or highly resistant to pea-mosaic. Observations made in the field both at Palmerston North and Blenheim suggest that there are certain other varieties which do not develop mosaic, and experiments are being carried out to test for immunity the more commonly grown pea varieties in New Zealand.

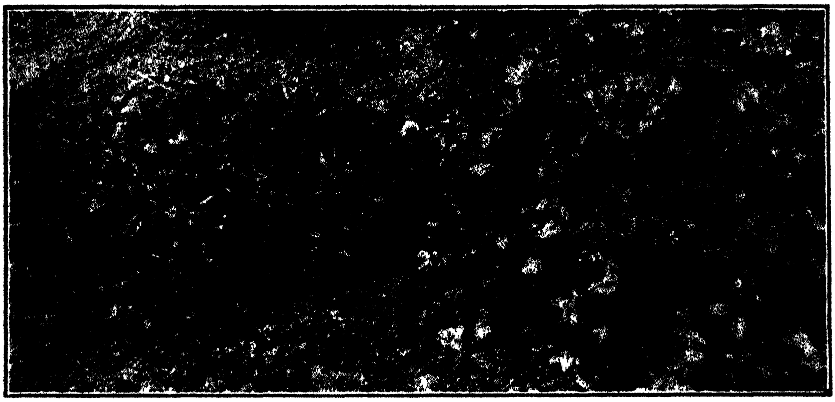

FIG. 6. THE STUNTING EFFECT OF PEA-MOSAIC ON RED CLOVER. HEALTHY PLANT ON RIGHT.

[*Photo by H. Drake.*

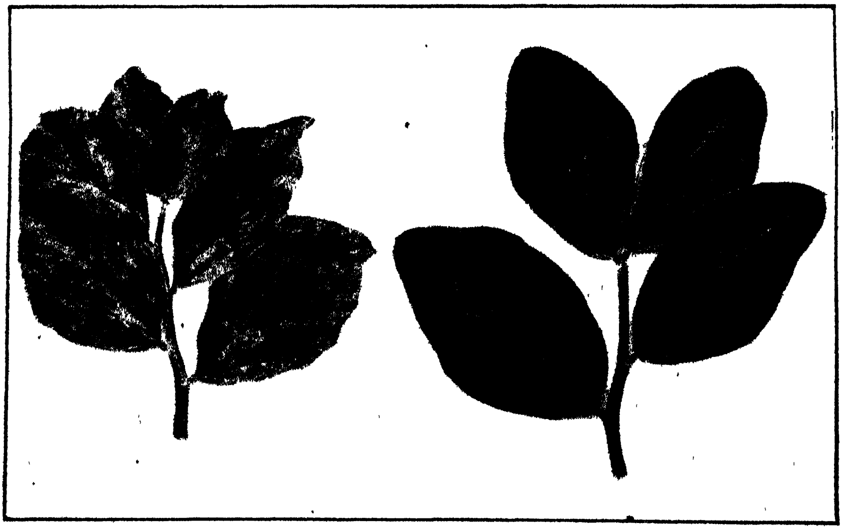

FIG. 7. MOTTLING OF BROAD BEAN LEAF CAUSED BY PEA-MOSAIC. LEAF FROM HEALTHY PLANT ON RIGHT.

[*Photo by H. Drake.*

PREVENTIVE MEASURES.

Experiments carried out at the Plant Research Bureau have shown that spraying to destroy insects does not give an effective control of pea-mosaic.

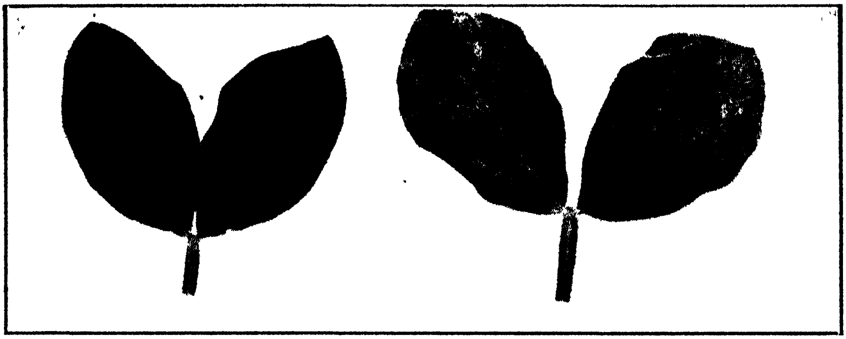

FIG. 8 MOTTLING OF SWEET-PEA LEAF CAUSED BY PEA-MOSAIC. LEAF FROM HEALTHY PLANT ON LEFT.

[*Photo by H. Drake.*

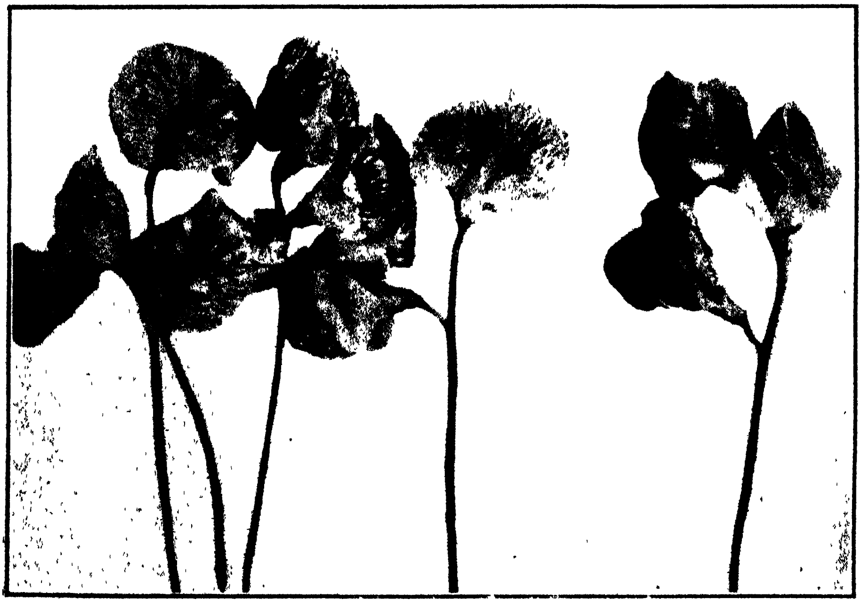

FIG. 9. STREAKING OF SWEET-PEA FLOWERS CAUSED BY PEA-MOSAIC. FLOWER FROM HEALTHY PLANT ON LEFT.

[*Photo by H. Drake.*

Alternative methods are (*a*) the growing of susceptible crops as far removed as possible from areas of infected red clover, and (*b*) for peas, the use of immune varieties.

SUMMARY.

1. Pea-mosaic, a virus disease of garden and field peas, blue lupins, red clover, broad beans, and sweet peas, is prevalent throughout New Zealand.
2. On peas, red clover, broad beans, and sweet peas it causes a mosaic mottling of the foliage, accompanied, in the case of the first three hosts, by a marked stunting of the plants. On blue lupins it causes a brown necrosis of the stem followed by death of the plant.
3. The aphides *Myzus persicae*, *Aphis rumicis*, and *Macrosiphum gei* have been shown to be vectors.
4. The disease overwinters on red-clover plants and is spread to other susceptible hosts by migrating aphides.
5. The garden-pea varieties Lord Chancellor and Little Marvel have been found to be immune.
6. The suggested control measures are: (*a*) Use of immune pea varieties, and (*b*) the planting of susceptible annuals far removed from areas of infected red clover.

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NEW PERMANENT PASTURE AS GREEN-FEED IN CANTERBURY.

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THE Canterbury farmer depends upon supplementary green-feeds as part of the diet of sheep and dairy cows. A low and uncertain rainfall necessitates the use of such feeds in dry autumns for maintaining the milk-production of cows and for the flushing of ewes. Green-feed for lambing is a well recognized essential, especially on medium and light lands. The actual extent to which the farmer is dependent upon such feeds is seldom realized fully until the occurrence of a very dry period. For instance, the low lambing-percentages and high mortality in the spring of 1933 can be attributed in general to defective or unbalanced nutrition arising from feed-shortage. This feed-shortage occurred in the spring and autumn of that year. Both seasons were dry, and supplementary green-feed crops were very much reduced in production. Had there been ample and better-balanced green-feeds or abundance of freshly grown grass, as occurs in seasons of high rainfall, for autumn and spring flushing and for lambing, more lambs would have been born and more would have survived.

Many Canterbury farmers summer-fallow a paddock which is sown to Italian rye-grass in February for the purpose of providing a large volume of green-feed at the appropriate seasons. The fallow-period may extend from the time turnips are eaten off—about the end of September—to sowing-time in early February, a four months' fallow. The aim is usually a two or three months' fallow-period. Where oats are sown for green-feed, often the fallow-period, especially on the lighter soils, occupies two months. Although under many systems of farm-management it would be difficult to do away with such green-feeds, it is well recognized that their cost of production is high when considered on a food-unit basis. The question may well be asked, then, if green-feed could be provided in any cheaper manner and, if in the establishment of permanent pasture on soil fallowed as for Italian rye-grass, sufficient green-feed could not thereby be provided so that ordinary temporary green-feeds may be largely dispensed with, or, at least, reduced in area with advantage. It is the object of this article to discuss this question and to show that new permanent grass can provide at least a part of the green-feed ration.

GREEN-FEED CROPS: METHOD OF GROWING, USES, ETC.

Green-feed is usually provided by such crops as oats, barley, Italian rye-grass, kale, rape, and sometimes turnip-tops. Oats and Italian rye-grass form the main spring green-feeds, while these and others mentioned are used for flushing and for late-autumn feed. Turnips, as well as providing the bulk of the winter feed, often provide the very early spring supplementary feed, especially along the foothills.

On many farms green-feed oats or barley are sown after a grain crop. Under these circumstances, except on the best soils, little autumn feed is secured. Fair grazing is provided in the spring. If these crops are sown in February on land fallowed from December or earlier, then very good production is obtained in autumn, winter, and spring. Italian rye-grass is generally sown in January or February after a fallow, or it may be sown in February or March following a grain crop. It provides a bulk of feed in the late autumn, some winter feed, and good spring feed. Part or all of it, on good land, may be shut up in the late spring for seed-production.

When green-feed oats or Italian rye-grass are grown purely for green-feed, the cost per food-unit, or per sheep-week of grazing, is high. If seed-production or a chaff crop can also be secured the cost may be kept low, and this can be, and usually is, done on the better classes of land. On the medium and light lands, however, where the growing of large areas of green crops is the general practice, green-feed and a cash crop cannot be secured satisfactorily or profitably from the same sowing.

PRESENT METHOD OF SOWING GRASS.

In spring and summer many farmers sow grass with turnips, kale, or rape, and with oats in the autumn. The threefold object in adopting this procedure is to obtain (1) a better-balanced supplementary feed; (2) cheap sowing; and (3) a permanent pasture following the supplementary crop without the necessity of further tillage. Although a thin and open sward usually results from this method of sowing, in a normal season on light land the first object is generally achieved. The second, cheap sowing, may prove to be false economy, however, when the weed-invasion and lowered production resulting from the bare spaces of such a pasture are considered over a period of years. So far as a permanent pasture is concerned this object is at the best, only partially achieved by the production of a poor pasture for a few years. On heavy land the supplementary crop, if as good as it should be, often smothers the young establishing pasture to a large extent.

In either case, the young grass is severely treated by (1) the heavy tramping in autumn and winter when the higher yielding crop is being grazed, and (2) the severe grazing of rape and kale at an early stage and during dry weather. In connection with the latter consideration it is characteristic of sheep to eat out the lesser constituent before turning to the more bulky crop. With normal seedings for the supplementary crops this lesser constituent is nearly always the pasture. The supplementary crop also uses a portion of the fertilizer which might be available to the pasture-plants.

In general, the practice of sowing permanent pastures along with a supplementary feed crop is unsatisfactory. Because of the smothering and the early severe grazing, often little autumn, winter, or lambing green-feed is obtained from the new pastures sown down with these supplementary crops.

ESTABLISHMENT OF PERMANENT PASTURE.

From the point of view of season and fallow, permanent pasture sown alone on a firm seed-bed could be established in the place of any of the crops that have been under discussion above. The only exception to this is that first-class permanent pastures rarely can be established in the autumn following a grain crop, though fair green-feed oats can be grown.

The best method(1) of permanent-pasture establishment, whether it be on heavy or light land, is that of sowing a suitable mixture of truly perennial strains alone on a properly prepared and well-fallowed seed-bed. The length of time between the original ploughing and the sowing should not be less than three months. Deep cultivation should be completed at least six weeks before the intended sowing-date, and the final period should be filled in with surface-working only—that is, suitable light harrowing and rolling that result in moisture-conservation and weed-control, and leave, ultimately, a fine, firm, moist, weed-free seed-bed. Sowing a pasture under such conditions in October or November, on almost any soil, gives a good germination, a rapid establishment, and a complete cover. Where annual weeds such as fat-hen and spurrey are excessively troublesome early autumn (February) sowing is quite satisfactory. If properly regulated grazing is maintained, particularly in the first year, a good permanent pasture is assured. The new pasture provides luscious grazing as green-feed as soon as it is several inches high.

SEED-MIXTURE.

The seed-mixture which is recommended for maximum green-feed production and a permanent pasture, and which can be grazed in a hard manner for a short time if absolutely necessary, is the dominant-rye-grass type as follows :—

	Pounds per Acre.
True or certified perennial rye-grass	30 to 35
Akaroa cocksfoot	5 to 7
Montgomeryshire red clover	3 to 4
Wild or certified white clover	1 to 2

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(1) *New Zealand Journal of Agriculture*, September, 1933, pp. 176–180.

On heavy land cocksfoot may be omitted from this mixture, and on light or poor land subterranean clover at 1 lb to 2 lb. per acre should be included. At present-day prices this mixture costs 18s. to 24s., say, £1 per acre. To those accustomed to sowing temporary strains of seed this cost may seem excessive. That this is not so, however, may be appreciated by the long-term view being taken: the cultivation costs are no more for the establishment of this permanent pasture than for the proper sowing of a temporary pasture.

As against green-feed alone, the cost may appear even more excessive, but it is easily offset by the cultivation, seeding, and manuring costs of green-feed production over a period of, say, five years, during the whole of which time the one permanent pasture is involving no other expenditure than that of annual top-dressing

TIME TO SOW PERMANENT PASTURE FOR MAXIMUM GREEN-FEED PRODUCTION.

The establishment of good rye-grass pasture may be obtained by autumn sowing, and on heavy land in a high state of fertility early autumn sowing of cocksfoot and clovers may be highly successful. Because of better weed-control, early autumn or summer sowing on heavy or weed-infested land is preferred. The degree of success, although dependent upon the weather experienced at and after sowing, varies with the length of fallow and fitness of the seed bed These pastures usually give late autumn green-feed for fattening late lambs, for flushing of ewes, and abundant spring green-feed It would probably be April, at the earliest, before grazing could be commenced--assuming a February sowing Sowing should generally take place in February, and certainly not later than the end of March.

On the medium and light land spring and early summer sowings are not affected, as a rule, by the annual weeds that are troublesome on the heavy lands. Along the foothills of Canterbury, however, spurrey (or yarr) may be troublesome in certain areas. Although December sowing is desirable on these foothill lands, January and February sowings on well-fallowed land make a rapid and thorough establishment, on account of the favourable rainfall that generally occurs On these areas extremely good pastures have also been obtained by sowing alone in November and December on well-fallowed land after turnips

On every class of land the earlier the sowing can take place the longer will be the green-feed season. On light land, pasture sown at the end of September should be ready for grazing in December. According to the conditions of rainfall and fertility such a pasture will give green-feed throughout the autumn and up to October of the following spring.

Regardless of the time of sowing, the green-feed value of the pasture disappears with the approach of November, about thirteen months after spring sowings and eight months after autumn sowings, because, firstly, the rye-grass (especially on lighter soils) tends to shoot rapidly to seed at this time, and, secondly, there is usually adequate feed from the other grazing pastures.

In general, and especially on medium and light land, spring and early summer sowings are the best for securing maximum green-feed and a good mixed pasture, and should be the aim wherever tillage and weed conditions will permit.

USES AND MANAGEMENT OF NEW PERMANENT PASTURE.

In a season of average rainfall a new permanent pasture of the type described, and sown in October or November as indicated, should be ready for a light grazing in the latter part of January or the beginning of February. Throughout the autumn, provided that rainfall is adequate and nor'westers are not too frequent, such a pasture provides useful green-feed, and if reserved for special purposes such as lamb-fattening or flushing of ewes and rams allows a reduction in area of feeds grown for these purposes.

It has been found that such a pasture on medium land, throughout the autumn period, fattens five or more lambs per acre without supplementary hand-feeding. With ½ lb. wheat per lamb daily, eight to ten lambs per acre have been fattened. With a very light seeding of ½ lb. rape per acre on this class of land eight to ten lambs per acre have been fattened, and it has been found that this thin supplementary crop does not, with proper grazing-management, harm the new permanent pasture. The fattening-period should not occupy longer than two to three months.

By spelling the new pasture depending upon the use to which it is to be put, late autumn feed, some winter feed, and spring lambing-feed can be obtained. Except in the case of fattening lambs or cull ewes, this pasture should, of course, be rationed at the rate of two or more hours per day as is good practice with green-feeds.

In the spring ewes and lambs should be put on in groups of several days lambing, or mobs of ewes and lambs may be put on breaks for several hours daily. At no time should the pasture be subjected to hard grazing for a lengthy period. This is important, particularly if the cocksfoot and clovers are to be given a fair start.

The permanent pasture sown in October, November, or December under average-rainfall conditions assists in the provision of the following: lamb-fattening feed, flushing feed, late-autumn feed, some winter green-feed, spring flushing-feed, and lambing-feed up to October or November following sowing. At this time the rye-grass begins to shoot to seed, and the whole or part of such a pasture may be shut up for a profitable seed-crop. If a high yield of easily cut seed is desired, shutting up at the end of September for medium and light land and the middle or end of October for medium to heavy land is necessary.

If not used for seed-production, the pasture may be grazed in the usual manner throughout the spring. Under ordinary grazing-conditions a payable yield of seed may be obtained by means of stripping.

Gentle or light grazing from October onwards allows the cocksfoot and clovers to recover after the closer grazing during lambing. By spelling the pasture from mid-November to about the end of December, a bulk of succulent grazing may then be obtained from the clover in the sward in late December and January at a time when it is most valuable for maintaining ewes and lambs in a thriving condition.

The rye-grass that shoots to seed during this "spelling" period, even if it is not stripped, need not cause any concern, because under Canterbury conditions, if the pasture and stock are to receive the best treatment, and if fat-lamb production is the object, some seed-stalks cannot be avoided—even with continuous grazing. If grazing in the first year is hard enough to prevent the growth of seed-stalks, then cocksfoot and clover development is very poor, the value of the pasture in January and February is lost, and fat-lamb production is proportionately retarded.

CARRYING-CAPACITIES OF NEW PERMANENT PASTURES USED AS GREEN-FEED.

Although there are no comparative figures for green-feed oats, Italian rye-grass, and new permanent pastures grown under experimental and exactly similar conditions, yet records have been kept of the grazing obtained from new permanent pasture when grazed as though it were green-feed. A few representative figures are given in the following table:—

Table I — Carrying-capacity of New Permanent Pastures when grazed as Green-feed: Dry Sheep or Ewes per Acre, by Months.

Locality	Light Land (Plains).	Light Land (Foothills).	Medium Land (Foothills)		Medium-heavy Land (Plains).
Grass sown.	November, 1932.	November, 1933	November, 1933	December 1933.	November, 1933.
January	Very dry Autumn.	Wet Autumn. ..	7·63	..	7·12
February		7·96	14 50	..	12·01
March		4·60	9 20	2·20	3·68
April		3·81	8·96	5·30	3·85
May		3·05	3·59	5·60	3·66
June .. .		2·31	..	2·73	1·06
July	0·13	0·91	.		..
August	0·62	1·84	.		.
September ..	3·81	3·02	0·07		Shut seed lodged, and only 20 bushels per acre saved.
October	3·29	9·06	5·20	No records kept.	
November	3·47	6 93	2·30		
December	1 35	2·84	1 40		

Records have also been kept of the grazing obtained from green-feed oats and from Italian rye-grass whenever opportunity permitted. Some of these figures are given below:—

Table II. Carrying-capacity of Green-feed Oats and Italian Rye-grass when used as Green-feed: Dry Sheep or Ewes per Acre, by Months.

Locality.	Green-feed Oats			Italian Rye-grass.	
	Light Land (Plains).	Light Land (Plains).	Medium-heavy Land (Plains).	Light Land (Plains).	Heavy Land (Plains).
Sown.	January, 1930.	March 1934.	February, 1932.	February, 1930	February, 1930.
March	0·86	..	..	..	..
April	9·28	0·11	..	0 81	1·13
May	..	3·18	0·34	2·10	2·14
June	..	1·15	1·95	0·10	3·36
[illegible] ..	..	0·73	9·65	0·14	0·14
[illegible] ..	0·32	0·95	0·07	0·23	2·12
September ..	3·76	3·94	0·07	4·28	3·58
October ..	2·60	4·23	8·77	3·45	5·34
November ..	2·50	4·48	2·97	2·84	2·58
December ..	..	4·71	2·81	2·28	Yielded 49 bushels per acre
January ..	..	2·18	..	?	
February ..	..	..	..	?	7·60

It is not intended that these tables should be taken as truly comparative of the grazing-capacity of new permanent pasture as against that of green-feed, nor should it be imagined that an attempt has been made to prove that new permanent pasture when properly sown can equal during its first year the production from similarly sown Italian rye-grass. But the figures do indicate that new permanent pasture sown alone, in the fashion outlined, is capable, under ordinary circumstances, of giving satisfactorily high grazing when used as green-feed. It should be stated that the examples recorded above have been used because the methods of tillage and seed-bed preparation and the grazing procedure were under close observation, and are known to have been most satisfactory.

CONCLUSION.

Where permanent pastures are desired, whether it be on light or heavy land farms, the method of establishment and grazing-management as outlined is economically applicable to at least one paddock each year.

Such a practice allows some reduction at least in the area of costly temporary feeds ; on account of the method and time of sowing, successful establishment is almost certain ; by correct management valuable feed is obtainable at every special "green-feed" season for a period of approximately one year ; the production of a valuable strain of seed is possible in the first harvest year if desired, but otherwise in later years ; and, finally, a truly permanent first-class pasture is established This last consideration, on all farms except those of the dominantly cropping type, and they are few, cannot help but appeal to the farmer who has tried the method thoroughly.

This method of establishing and managing new permanent pasture has become a definite part of a profitable programme on a large number of Canterbury farms.

BACTERIOLOGICAL EXAMINATION OF EXPORT BUTTER.

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A SURVEY of the literature dealing with the bacteriological content of butter gives a rather confusing impression. On one hand many butters containing large numbers of bacteria are classed as superior by those best qualified to judge, while on the other hand lower-grade samples have frequently been found to contain comparatively few organisms. The tendency for some years has been to devote most time to determinations of the yeast (and mould) content of butter, as these are held to provide a good indication of the sanitary conditions in the factory. On the other hand, few yeasts appear to be capable of actually spoiling butter, while small numbers of lipolytic (fat-spoiling) bacteria may do serious damage by actually decomposing the butterfat. Proteolytic types may also decompose the curd, and some of the lipolytic germs are said to be potent also in this respect. It is conceivable that a butter may be seriously infected with other organisms than yeasts, so that, if a yeast count alone is relied upon to indicate factory conditions, some cases of bad contamination may be overlooked. Counts of other organisms besides yeasts seem, therefore, to be necessary.

In order to deal with large numbers of samples, simplified methods are essential. Barkworth(1) has reported favourably on Van Oijen's modification of the Frost Little Plate method as a quick and economical method for examining clean milk. For rapid determinations of the yeast and mould content of butter Johns(2) has also devised a modification of the Frost method, which he called the microplate method. This we have further adapted, so that by the use of different media, various counts may be made rapidly. Such counts include total agar count, yeast and mould count, count of fat-splitting germs (as indicated by nile blue sulphate agar), and count of heat-resistant germs. The coliform content has also been estimated by the method suggested by Grimes(3). The reliability of the microplate counts has been checked by comparisons upon eighty-four samples, for which, in addition, the usual Petri-plate methods were employed. Satisfactory agreement of lower counts was observed by the two methods, including the majority of the yeasts and fat-spoiling types The total agar counts also gave reasonable agreement in most cases, but there was a tendency for the Petri-plate figure to exceed the microplate figure as the total increased. This was perhaps due to the effect of crowding on the microplate. However, the few occasions on which they differed appreciably were of no significance, as both counts were still high or low, and no case occurred of a high count on one and a low count on the other.

On account of the saving of time especially (as well as of material), these methods have enabled much larger numbers of samples to be examined than the usual Petri-plate method would have allowed. During the 1935-36 season the bacteriological condition of over 370 samples of salted butter passing through the Auckland Grading Store was determined at the Wallaceville Dairy Laboratory. The following is a summary of the results obtained during the period from 22nd November, 1935, to 6th August, 1936, inclusive :—

—	Number of Samples.	Percentage of Total.
Agar counts per gram—		
Under 10,000	137	37
10,000 to 50,000	167	45
50,000 to 100,000	16	4
Over 100,000	50	14
Fat-destroying germs per gram—		
Up to and including 100	243	66
100 to 1,000	84	11
Over 1,000	42	23
Yeast counts per gram—		
Up to and including 100	82	22
100 to 1,000	203	55
Over 1,000	87	23
Coliform germs per gram—		
Absent	184	51
Trace	51	14
Present	86	24
Many present	41	11

The significance of the various counts can be explained in a broad sense as follows :—

The agar count is an indication of the total number of bacteria present, *excluding* lactic streptococci ("starter" bacteria). The culture media used is made up in such a way that the growth of this type is discouraged owing to the absence of milk sugar. The count of fat-destroying germs is perhaps the most important, as practically all these germs are capable of producing bad flavours in butter. The yeast count and also the coliform content give an indication of the bacteriological state of the factory equipment, particularly of the churns, as these types are among the most easily destroyed by heat. The types which have been called " heat resistant " consist chiefly of yellow cocci such as are frequently found upon dairy equipment in deposits of slime and milk stone, which are located in pockets such that they escape the usual washing processes. Regular and thorough washing followed by steam sterilizing is necessary to avoid them. In many cases such heat-resistant types amount to a large proportion of the total count. The method of estimating this type proved in practice to be less reliable than the other methods. A longer time of incubation usually increased the figure, but, in the case of samples with high agar counts, the heat-resistant types failed to develop their characteristic colour, and could not be counted. For these reasons they are not included in the table. Moulds were found in only a very few samples.

Present factory methods of cream pasteurization at high temperatures yield cream which is almost sterile. Thus the various counts considered together may be assumed to reveal the extent of recontamination of the cream and butter subsequent to pasteurization, so that the results obtained should be a valuable indication of the sanitary condition of the factory plant. High figures provide definite evidence of the need for a " clean-up," even if the butter quality shows no signs of being adversely affected. A heavy infection of harmless germs may easily include one day a large number of types capable of doing serious damage.

From the figures given it is apparent that the bacteriological condition of a great many samples is satisfactory. Some 20 per cent., however, are not what they ought to be, on account of either excessive numbers, or bad types of organisms being present. In view of the fact that so much of the butter is turned out in satisfactory bacteriological condition, it should be possible for all butters to be of this standard.

As to the relation of these results to the grade of the butter, in the first place it should be emphasized that such tests are not intended to be used to grade the butter. In a few cases lower-grade butter was found to be of unsatisfactory bacteriological condition, and it was a fair assumption that the bacteria present were the major cause of the defective condition. But it is well known that besides bacteria a variety of other causes can be responsible for inferior quality. On the other hand, a number of cases occurred when finest butter was unsatisfactory in its bacterial content. This cannot be regarded as a desirable state of affairs, even if the butter suffers no apparent harm. The keeping-quality of such butter may be unsatisfactory. Bacteriological testing should serve a useful purpose in checking factory conditions and drawing attention to potential causes of trouble.

More samples are being examined during the present season, and these will be the subject of a further report. A more detailed account of the new methods together with the modifications and improvements developed by the laboratory will also be published later.

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CARCASS-QUALITY IN BACON PIGS.

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PART I.—NEW ZEALAND BACON PIGS IN RELATION TO UNITED KINGDOM MARKET REQUIREMENTS.

The export from New Zealand of frozen pig carcasses suitable for conversion into bacon is a comparatively recent development of the New Zealand pig-industry. Recognizing that types of pigs and feeding practices common in New Zealand are radically different from those in European countries supplying the United Kingdom market, the Manawatu-Oroua Pig Development and Recording Club designed the experiments detailed below to determine (*a*) the suitability for the United Kingdom market of the various types of bacon pigs in New Zealand, fattened on different dairy by-products, and (*b*) whether the supplementing of factory buttermilk with meals improves the quality of carcasses and/or the financial returns.

In designing the experiments the club wished to ascertain in particular whether the Tamworth, Berkshire, and Tamworth-Berkshire crosses of varying degree so peculiar to New Zealand and Australia produce carcasses markedly different from the white breeds of European countries, and whether the feeding of fattening pigs almost exclusively on dairy by-products is fundamentally sound in respect to both the financial returns and the quality of the product. The quantitative and economic results have been reported in another paper(9). The present communication is concerned only with the carcass-quality of the pigs. This is divided into two parts, the first being a study of the quality of carcasses produced from pigs of various breeds and crosses, reared and fattened on different farms, and the second dealing with the influence on carcass-quality of supplementing buttermilk fed to fattening pigs with concentrate meals at varying rates and over varying growth-stages.

SOURCE OF PIGS AND METHOD OF EXAMINATION.

Arrangements were made by the club's recording officer (Mr. W. J. Croucher, who also carried out the inspection and measurement of the pigs and the arranging of the trials) for a number of farmers to market selected lots of pigs representative of the average quality of New Zealand baconers, through one organization, which arranged for the slaughter, freezing, export, and disposal of the carcasses. In addition, pigs were available from feeding trials conducted at the farm of the Cheltenham Dairy Co., Ltd., and these were marketed through the same channel. Table 1 gives details of the number of pigs slaughtered and exported.

Table 1.—Source and Number of Pigs.

Source of Pigs.	Shipment Year.	Number of Carcasses examined.	Number of Carcasses exported.	Number of Farmers or Lots.	Number of Breeds or Crosses.
Farmers	1935	132	118	18	7
,, ...	1936	11	11	1	2
Experimental ..	1935	80	66	8	2
,, ..	1936	40	36	5	2
Total ..	..	263	231	32	9

The pigs were slaughtered at the Kiwi Bacon Factory, Longburn, where as complete an examination as possible without cutting of the carcass was made. The carcasses were suitably identified, frozen, and shipped to London as the numbers accumulated. Here they were examined by the New Zealand Pig-carcass Evaluation Committee, established for the purpose, and composed of recognized authorities on carcass-quality(1). In each year the carcasses were examined at the same time. The order of reference under which the committee worked was as follows: "The general object of the consignments is to obtain critical and candid expert United Kingdom opinion upon all carcasses as to their suitability in respect of quality and weight for the United Kingdom bacon trade, the reports to indicate any specific weaknesses or defects to which the attention of the New Zealand producer might profitably be directed." The system of examination employed was very comprehensive and thorough, and was as described by Davidson, Hammond, Swain, and Wright(1). Complete data for each carcass on a basis of this method were supplied by the committee, together with individual photographs of loin-cuts. The committee also presented a statement covering the general conclusions reached.

It is convenient to note at this stage a slight variation in the method of examination in the evaluation of "proportion of fat" and "streak." In the 1935 shipment the former was measured at the "point of eye," while in the 1936 lots, at a point "1½ in. in from the middle line" on the loin-cut. The streak was evaluated by measurement on the loin-cut in 1935 and by eye assessment and standard photographs in 1936(1). Otherwise the methods used were identical for every carcass.

SUMMARY OF EVALUATION COMMITTEE'S REPORT.

The following extract from their reports summarizes the views of the committee:—

> "(a) *Conclusions.*—Viewing the shipments from a broad quality-angle, the following generalities may be made—
>
> "(1) The outstanding defect was a general deficiency in length, which is one of the most desirable characteristics in pigs destined for the Wiltshire bacon trade. Broadly, these pigs averaged 738 mm. for length of loin as against 800–850 mm. for Danish pigs of comparable weights.
>
> "(2) The consignments as a whole were good in relation to thickness of streak, eye of meat (indicating presence of ample lean meat), fineness of shoulders, and the hams were of good conformation.
>
> "(3) The thickness of back-fat was, on the whole, fairly good.
>
> "(4) It is emphasized that pigs below 126 lb. in weight are too light for the bacon trade.
>
> "(b) *General Policy.*—The present position would appear to be that baconer pigs now being exported from New Zealand are the surplus pigs of the porker trade fed on to bacon-weights. In other words, the present baconer pigs

> appear to be porker-type pigs fed to bacon-weights and so are short in length in relation to weight. If the baconer pig from New Zealand is to be merely a by-product of the porker trade, we would advise marketing the present type of comparatively short pig at the lower bacon-weights—*i.e.*, at weights below the present English standard minimum of 140 lb. Otherwise there will be a marked and undesirable disproportion between length and fatness. If taken on to heavier bacon-weights the extra weight will be mostly fat and would result in a pig unsuitable for the bacon trade. It should be emphasized, however, that this type of low-weight baconer pig has a somewhat limited market which could be easily saturated. On the other hand, if New Zealand is going to make the baconer pig a primary product with a view to competing with the Continental type of pig it is vitally necessary that a different type of pig having greater length and maturing at a rather heavier weight should be bred. The development of this policy should not impinge on or adversely affect the present porker production, which has now attained a high standard and is of considerable importance in that it has few competitors compared with the baconer trade in the United Kingdom market at the present time.
>
> "If it is thought desirable to introduce this new type of baconer it should be largely additional to the present pig trade and not as a substitute for it."

The above statement is illuminating in several directions and deserving of the serious consideration of producers, breeders, and others interested in the development of a profitable and extensive export bacon trade. The position calls for a more detailed presentation and examination of the data on which the observations have been based.

CARCASS-QUALITY RESULTS.

Limitations of space preclude presentation of the detailed measurements and other data for the individual carcasses. The system of award of marks according to a definite scale on a measurement basis makes it possible, however, to obtain a reasonable picture of the average results, by expressing the actual marks received for the individual and total points as percentages of the possible awards in each case. This method overcomes the disadvantage of weight-disparities in making comparisons. It fails to allow for differences in the relative importance of the different points, however. The fact that eye of loin, length, proportion of fat, and streak together account for 80 per cent. of the possible marks in carcass-quality as a whole (hams, shoulders, and leg-length being of less importance) should be borne in mind in examining the figures. Comparisons between each farmer's lot and between the different breeds and crosses are set out for quality as a whole and for the individual characters in Table II (next page).

Table II —Summary of Carcass-quality Results: Individual Farmers' Lots and "Breed or Cross" Groups.

Individual Breeders' Points.		Hams.	Shoulders.	Streak.	Eye of Loin.	Fat.	Length of Loin.	Length of Leg.	Total Breeders' Points.
Possible marks ..	..	8	7	12	28	20	20	5	100
Code Letter.	Average Weight.	Percentage of Possible Marks (Average).*							
TAMWORTH × BERKSHIRE CROSS (NUMBER OF CARCASSES, 149).									
J. 2 ..	126 lb.	82	79	88	79	78	53	90	75
P. 18 ..	136 lb.	72	84	81	69	78	53	42	69
FT. 93 ..	137 lb.	77	75	92	57	78	27	66	63
H. 6 ..	127 lb.	65	84	89	61	80	33	30	63
L. 4 ..	119 lb	66	71	88	43	74	54	70	62
E. 6 ..	137 lb	86	86	89	57	47	46	67	61
F 7 ..	128 lb	91	71	89	52	54	31	89	59
G. 7 ..	142 lb	61	86	53	63	65	35	51	58
S. 6 ..	144 lb.	80	76	79	37	26	15	93	44
Totals ..	136 lb.	75	78	85	58	70	35	62	62
TAMWORTH × LARGE WHITE CROSS (NUMBER OF CARCASSES, 25).									
M. 8 ..	134 lb.	72	77	88	58	88	57	33	69
C. 3 ..	125 lb	67	95	89	35	82	58	33	62
K. 6 ..	126 lb.	46	84	71	46	84	57	20	60
B. 8 ..	132 lb.	65	80	88	32	76	46	49	57
Totals ..	130 lb.	62	82	84	43	83	55	33	62
TAMWORTH × LARGE BLACK CROSS (NUMBER OF CARCASSES, 37).									
A. 4 ..	131 lb.	91	90	65	61	85	33	80	66
C2. 6 ..	145 lb	95	88	66	63	87	30	60	66
N. 7 ..	143 lb.	65	84	79	80	63	22	46	62
FT. 20 ..	142 lb.	63	77	87	50	69	28	44	57
Totals ..	140 lb	75	83	77	62	74	28	53	62
LARGE WHITE × BERKSHIRE CROSS (NUMBER OF CARCASSES, 15).									
R. 9 ..	145 lb.	79	70	75	54	82	47	62	63
C. 6 ..	144 lb.	98	100	69	36	87	18	60	57
Totals ..	145 lb.	86	82	72	47	83	35	61	60
PURE BREEDS (T = LARGE WHITE; D = TAMWORTH; Q = LARGE BLACK). (NUMBER OF CARCASES, 18.)									
T. 6 ..	147 lb.	78	81	56	41	64	71	42	60
D. 5 ..	136 lb.	65	80	77	52	73	64	24	63
Q. 7 ..	135 lb.	68	71	77	56	87	43	29	63

* "Breeders' marks" only. See Reference(1).

The average value of the carcass-quality awards over all the pigs was approximately 60 per cent., a figure leaving much room for improvement. Individual farmer's lots varied from 44 per cent. to 75 per cent. in carcass-efficiency. The most common and serious cause of failure to reach high standards was shortness in length of loin. This was responsible for an average value of approximately 40 per cent., and, in the case of individual lots, for a variation of from 15 per cent. to 71 per cent. The figures bear out the contention of the committee and point to the necessity for immediate attention to remedy this defect. Eye of meat gives a disappointing value and a fairly variable value of from 32 per cent. to 80 per cent. It seems evident that the outstanding merit of New Zealand pork carcasses in this important character(2, 3) is not a characteristic of many pigs of bacon-weights.

The proportion of fat in the carcasses is more satisfactory, a reasonable average standard of approximately 75 per cent. of the optimum being obtained, despite the general tendency of short-type pigs "to show a marked disproportion between length and fatness" Had a greater number of the pigs been carried to heavier weights it is conceivable that the situation might not have been so favourable, but more in keeping with the committee's comments.

The relatively good values obtained for streak are surprising in view of the frequent adverse comment from trade interests upon this quality-point. This apparent contradiction results from the fact that while the thickness of the streak in proportion to the weight of the carcass was excellent, the actual thickness was insufficient, due to the low average weight of the pigs This emphasizes one of the disadvantages to the trade of low-weight baconers. While the proportions of such carcasses may approach the ideal, the actual measurements of a particular area, such as the belly region, may render the latter almost valueless On the basis of this argument and the actual results obtained it is evident that much of the trade criticism of the bellies of New Zealand baconers should be overcome by marketing within the higher bacon-weight range. Hams, shoulders, and legs attained a good standard over the pigs as a whole, though individual lots show a low value for legs in some cases, due to excessive length of leg.

BREED AND CROSS IN RELATION TO CARCASS-QUALITY.

The average figures for the different crosses and breeds were remarkably close, showing a range of only from 60 per cent. to 63 per cent. for carcass-quality as a whole. This supports the view previously expressed(4) that there is little difference between New Zealand breeds and crosses as to gross efficiency.

Between the various breeds and crosses characteristic differences are apparent, however, in respect to carcass-quality. These may be summed up as follows :—

(1) Tamworth-Berkshire crosses are very good in hams, shoulders, streak, and eye of loin, but are distinctly short.

(2) Tamworth - Large-White crosses are superior to all others in length of loin, are better than the first-mentioned cross in proportion of fat, but inferior to all crosses in eye of loin, length of leg, and hams.

(3) Tamworth - Large-Black crosses are the shortest of all breeds and crosses compared, and have excessive leg-length. Otherwise they are comparable with the Tamworth-Berkshire group.

(4) Large-White - Berkshire crosses are good in proportion of fat, but deficient in loin-length and eye of meat. They have not the leg weakness of the Tamworth - Large-White cross.

(5) Although the numbers of purebred animals are small, the average values attained are of interest. Large Whites have the greatest length, being better than any cross in this character. They have inferior eye of loin awards, and low leg-values. Tamworths give good length and fat values, but inferior legs and hams. Large Blacks are short of loin and excessively leggy.

It must be emphasized that these figures and comparisons, in view of the relatively small numbers of pigs involved, may not necessarily be representative of these breeds and crosses in New Zealand, and may rather be the picture of the average quality of different strains. With this limitation the data indicate that it is possible to obtain reasonably good-quality carcasses from any of the existing breeds and crosses, though one may be, on the average, superior to another in respect to individual quality characters (Plate 1, next page).

As distinct from these interbreed differences, wide variations in both carcass-quality as a whole and in individual quality-points are apparent within each breed and cross. This feature of the results is of particular significance since it points to the existence within a breed of pigs of different "strains" of varying carcass-efficiency. Though it is conceivable that the variations referred to may be due in part to management and feeding, this is unlikely in view of the nature of the differences.

The wide variation in carcass-efficiency of 30 per cent. within the Tamworth-Berkshire cross illustrates the point, differences in length of loin, length of leg, and proportion of fat, either singly or in combination, being responsible. Some farmers are seemingly provided with definitely superior classes of stock irrespective of breed. The position may be put another way: the differences within any one breed or cross, particularly in respect to length of loin, points to the existence of distinct "types," some of which are more suited to bacon-production than others.

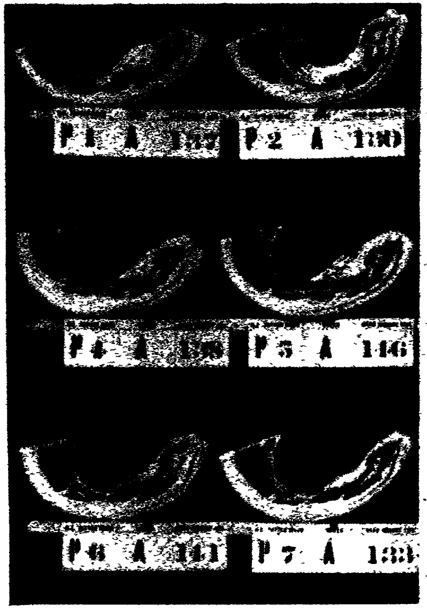
How far selection within these types will assist in the development of a higher standard in the national output is a matter of considerable moment. In this connection it is perhaps significant that within the Tamworth-Berkshire group—the most popular cross in New Zealand—no lot was capable of securing greater efficiency in length of loin than 54 per cent.

WEIGHT IN RELATION TO CARCASS-QUALITY.

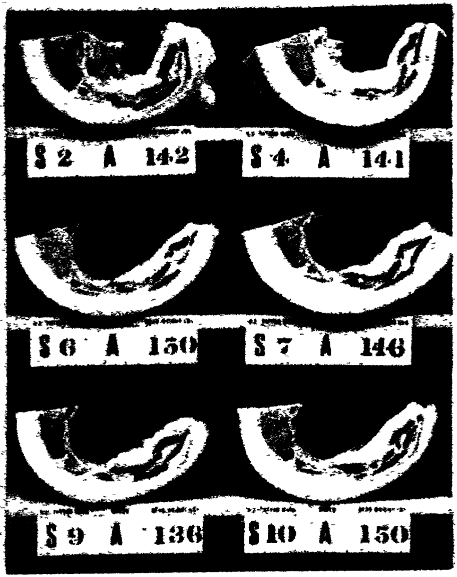
The emphasis placed upon weight of carcass as a factor in quality by the committee has led to an examination of the data available with the object of determining the relationship more closely than illustrated by the general statement. The contention that New Zealand pigs are of a type which mature at lighter weights than the bacon-weights more in demand involves the concept that changes in the relative proportion

PLATE I.

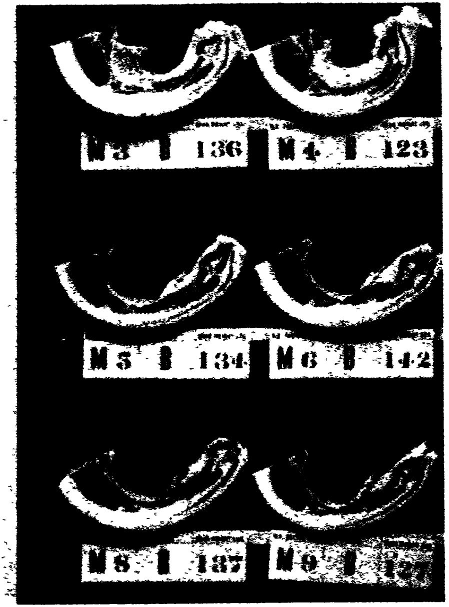
Tamworth × Berkshire.



Tamworth × Berkshire



Large White × Tamworth.



	Measurement. Mm.	Marks Per Cent.	Measurement Mm	Marks Per Cent.	Measurement. Mm.	Marks Per Cent.
Eye of loin ..	46·0	73	37·5	36	41·5	57
Fat ..	23·5	78	36·3	30	24·3	88
Length of loin ..	740·0	43	725·0	15	775·0	55
		—		—		—
Total breeders' points ..		70		44		69

of bone, flesh, and fat occur as the pig grows, and that the rate of development of such changes varies with the breed or " type " of pig. Bone develops first, flesh next, and fat last. Some breeds and types " mature," or have the desired proportions of bone, flesh, and fat, at lighter weights than others. This, on the one hand, makes some breeds and types more suited to pork-production and others to bacon-production, and, on the other, sets an optimum slaughter-weight for any given breed or type. An increase in weight above the optimum will be mostly fat and the resultant carcass less suited to market requirements(3, 5, 6).

Changes in length of loin, proportion of fat, and thickness of eye of loin, with changes in weight, have been investigated.

Table III.—Changes in " Length of Loin " with Increase in Weight.

Weight-range.	Number of Pigs.	Standard Length for Weight.	Actual Length for Weight.	Deficieny in Length.	Marks awarded.	Standard Increase with Weight.	Actual Increase with Weight.
lb.		Mm.	Mm.	Mm.	Per Cent.	Mm.	Mm.
115–119 ..	7	755	710	45	55	0	0
120–124 ..	12	765	716	49	50	10	6
125–129 ..	16	775	715	60	40	20	5
130–134 ..	46	785	726	59	40	30	16
135–139 ..	45	795	732	62	35	40	22
140–144 ..	41	805	730	75	25	50	20
145–149 ..	35	815	736	79	20	60	26
150–154 ..	19	825	733	92	10	70	23
155–160 ..	6	835	732	103	0	80	22

The relative length measurements at 5 lb. ranges from 115 lb. to 160 lb. are compared with the " standard " lengths for weight taken from the committee's published data(1). The deficiency in length relative to standard at each weight has been calculated, and the actual increase per 5 lb. increase in weight compared with the standard increase in length. Since the " standard " lengths for weight are based on the trade requirements for this character, and represent the ideal, the figures for the New Zealand carcasses measure the deficiency of the baconers at the various weights.

While length of loin has increased with increase in weight, the rate of increase has not been rapid enough, with the result that the deficiency below standard becomes progressively greater as weight of carcass increases. The effect is sufficient to penalize commercially the heavier carcasses.

The data indicate fairly conclusively that the length weakness in the present type of New Zealand bacon carcass, if this sample be taken as representative, will be less apparent at light bacon-weights, the pigs being of the relatively early maturing type in respect of length of loin—*i.e.*, comparable with pork-type pigs.

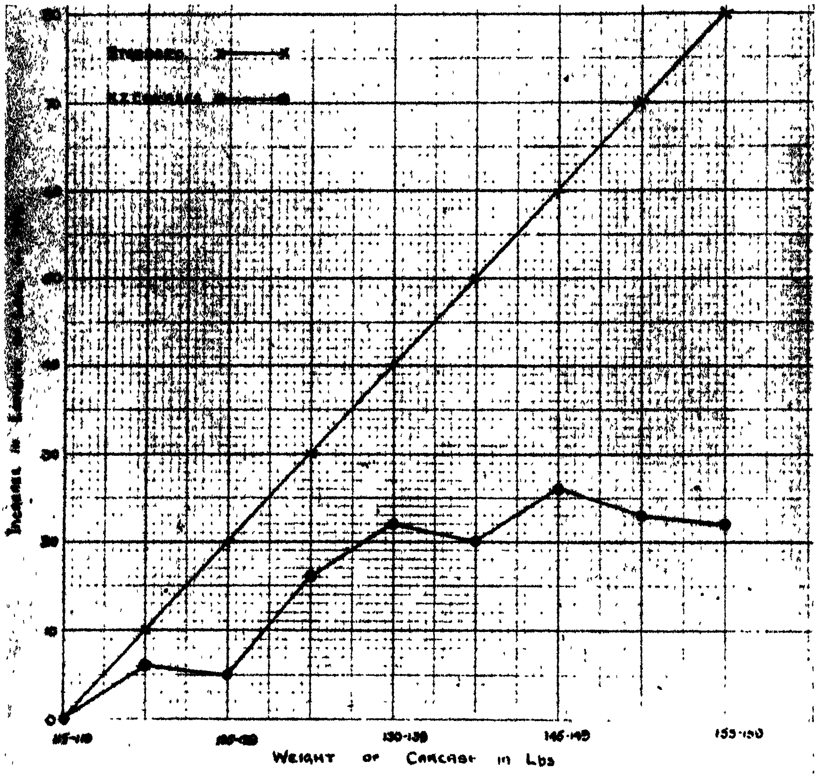


FIG I.

Similar figures for proportion of fat and eye of loin are set out in Table IV

Table IV — Changes in "Fat at Point of Eye" and in "Thickness of Eye" with Increase in Weight

Weight-range.*	Number of Pigs.	"Eye of Loin"		"Fat at Point of Eye"		
		Thickness	Marks.	Thickness.	Marks.	Standard Thickness
lb.		Mm	Per Cent.	Mm.	Per Cent.	Mm.
115–119	7	38·0	70	22·0	98	21·75
120–124	12	40·0	75	24·4	92	22·25
125–129	16	42·0	85	24·7	90	22·75
130–134	44	41·0	80	25·4	92	23·25
135–139	41	40·0	75	26·5	88	23·75
140–144	30	41·0	80	28·1	85	24·25
145–149	21	43·0	85	28·2	85	24·75
150–154	8	43·0	85	29·4	82	25·25
155–160	3	39·0	65	32·0	60	25·75

* Cold-dressed carcass-weight.

Eye of loin shows but little variation within the weight-ranges studied, its thickness tending to increase but slightly with weight-increase. This would lend support to the contention that flesh is an early developing part in the pig-carcass, the proportion as indicated by the eye measurement having reached nearly maximum development at the lower bacon-weights in these carcasses. That the increase is sufficient to conform with the desired standard increase is indicated by the relatively uniform percentage marks awarded. It is not likely that weight of carcass within the bacon-weight range is a material factor in influencing the eye measurement.

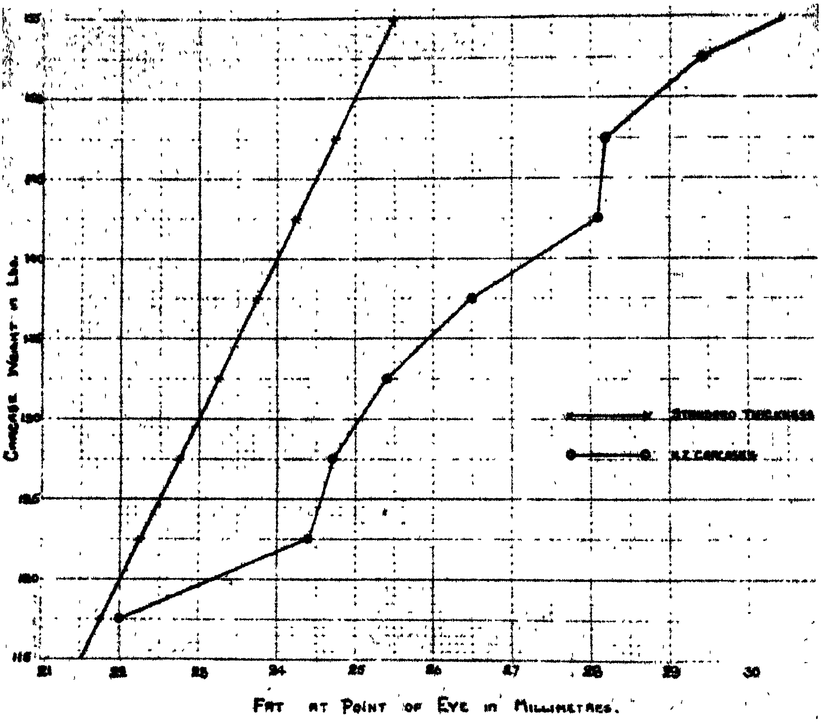


FIG 2.

Proportion of fat, on the other hand, shows a similar undesirable tendency to length, an increase in the thickness at point of eye occurring with increase in weight, and the increase being greater than required if the "standard" thickness for weight be taken as a criterion. The position is clear from Fig. 2.

The pigs tend to approach the ideal in proportion of fat more closely at lower weights than higher, but it is important to note that the effect is not nearly as great as in the case of length and makes little material difference at weights up to 140 lb. and even up to 150 lb. This situation is significant in view of the fact that it is frequently necessary to market at least a proportion of bacon pigs at weights above 140 lb. in consequence of the seasonal nature of food-supplies in New Zealand.

FARM FEEDS IN RELATION TO CARCASS-QUALITY.

The experiments have shown that the practice of fattening pigs in New Zealand on a ration entirely or almost entirely composed of dairy by-products is capable of producing carcasses of good quality. No difference existed between the average results of pigs fattened on separated milk, buttermilk, or whey, though fairly wide variations in quality were apparent in the pigs fattened on any one type of by-product. These latter were probably due to type differences—*i.e.*, Plate I: Lots P and S of the same cross fattened on buttermilk alone. It is possible also that the excessive fatness recorded in some lots was due to excessive feeding during the latter stages of growth(7, 8).

Little precise information on the effect of small variations in feeding practice can be gathered from consideration of even large numbers of pigs uncontrolled for other factors productive of material effects upon quality. Specially designed feeding trials are essential for this class of work.

THE IMPORTANCE OF LENGTH OF LOIN

A representative number of unselected bacon-sides from seven of the major supply countries in the United Kingdom bacon trade were measured in conformity with the method used throughout this investigation(1). The results show that New Zealand bacon pigs are shorter at all weights than those from competing countries.

Danish pigs have long been recognized as of outstanding length, but it is of interest to record the very excellent figures of Canadian products as coming on to the market at the present time. Canada has concentrated on improvement of this character during the last ten years by the adoption of special breeding and selection methods. The marked success which has attended her efforts in this direction suggests that her methods used merit serious attention by the New Zealand producer. The certificate-of-performance scheme for the improvement of pedigree pigs, instituted by the Manawatu-Oroua Pig Recording and Development Club in 1934, is based on the Canadian system, and offers to New Zealand pig-breeders a sound method of improvement of carcass-quality.

COMMERCIAL GRADING RESULTS.

In order to obtain an indication of the value of the pigs as assessed by commercial grading standards, all the carcasses studied in this investigation were graded also by the voluntary system in use at the export works concerned, and by the official grading standards in force in New Zealand in respect to bacon pigs used for both export and local consumption. In England the carcasses were also graded under the English official grading scheme at that time in operation. The results under the New Zealand and English official systems are reported in Table V.

Table V.—Commercial Grading Results

Grading System	New Zealand.*		English Bacon.†			
Grade	First.	Second.	A.	B.	C.	D.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Under 140 lb. . .	62	38	. .	. .	. .	. .
Over 140 lb.	25	75	40	28	21	11
All carcasses	45	55	. .	. .	. .	. .

Official Government standards.
Scheme.

At first sight the results under the English grading system are very pleasing, indicating as they do that even a larger proportion of the New Zealand carcasses reach the top two grades than many English pigs as indicated by published figures. The results are rather misleading, however, since the English standards do not involve length of middle in which New Zealand pigs notably fail. Again the fact that only 30 per cent. of the New Zealand pigs were able to be graded under the English scheme owing to the minimum weight-limit of 140 lb. reduces the value of the comparison.

The New Zealand grading results, which include " length standards," are probably more in keeping with the carcass value of the pigs. If " first grade " by this system be considered equivalent to grades A and B under the former system, it is clear that the length factor has been responsible for fewer pigs grading first in New Zealand. It is of interest also to record that the weight-length relationship previously noted is reflected in the commercial grading results when length is a factor, 65 per cent. of pigs below 140 lb. in weight grading first, as compared with only 25 per cent. on pigs over 140 lb. Increased proportion of fat in the heavier carasssces also played a part in this respect.

SUMMARY.

Considerable improvement is necessary in the present type of bacon pig exported from New Zealand if a high quality-status on the United Kingdom market is the objective of producers.

Shortness in length of loin is revealed as the most serious weakness. This is more apparent at high bacon-weights than at low, and points to the desirability from the quality viewpoint of marketing the present type of relatively short pig at weights below 140 lb.

Associated with this deficiency in length is a tendency toward overfatness. This is also correlated with carcass-weight and is penalizing to heavier carcasses, though the disadvantage of slaughter at weights above 140 lb. is not so acute as in the case of length.

Hams, shoulders, eye of loin (indicating proportion of lean meat), length of legs, and streak, attain a reasonably high standard on the average, though some types of pigs are defective in one or more of these characters.

There is little difference between the popular breeds and crosses in carcass-quality as a whole, though they may vary significantly in efficiency in respect to individual quality-points.

The Tamworth-Berkshire-cross pigs are too short in length of loin, while the Large White crosses are superior to others in this quality as well as in proportion of fat, though defective in other qualities. Differences within each breed and cross are very marked and point to the existence of suitable and unsuitable bacon strains. Selection within these on a carcass-quality basis is the logical line of attack in an improvement policy.

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TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1936.

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THE certificate-of-record testing position at the close of the calendar year 1936 indicates a slight decrease in the number of first-class certificates issued as compared with 1935. A feature of the year was the increase in the number of cows tested in the yearly division, and the definite falling-off in the number of cows entered in the 305-day division. During 1936 first-class certificates of record were issued to 534 cows, as compared with 554 cows in 1935 490 cows being in the yearly-test division and the remaining 44 in the 305-day division, the comparative figures for 1935 being 450 and 104 respectively

(1) C.O.R. YEARLY TEST DIVISION.

The 490 certificates issued during the year represented an average production of 509·0 lb. butterfat, a decrease of 7·3 lb. over the 1935 average of 516·3 lb. fat for 450 certificates

FIRST-CLASS CERTIFICATES ISSUED

The number of cows which have been granted first-class certificates since the inception of the certificate-of-record system in 1912 now totals 9,867. Subdivided into breeds this total represents 7,297 Jerseys, 1,807 Friesians, 462 Milking Shorthorns, 222 Ayrshires, 69 Red Polls, 2 Guernseys, and 8 Shorthorns. Table 1 provides a numerical summary of yearly certificates of the first-class issued during the past two calendar years :-

Table 1

Breed.	1936.			1935.		
	Ordinary.	Repeat.	Total.	Ordinary	Repeat.	Total.
Jersey	383	35	418	352	28	381
Friesian	43	13	56	44	12	56
Milking Shorthorn	9	2	11	10	..	10
Ayrshire	3	1	4	1	..	1
Shorthorn	..	..	..	1	..	1
Red Poll	1	..	1	..	1	1
Totals	439	51	490	409	41	450

SECOND-CLASS CERTIFICATES ISSUED.

Thirty second-class certificates were issued during the year, 22 being gained by Jerseys, 6 by Friesians, 1 by a Milking Shorthorn, and 1 by a Red Poll. The previous year's total was 24. In the past year the average production of the 22 Jerseys was 512·55 lb. fat, the 6 Friesians averaged 600·16 lb., while the 1 Milking Shorthorn was credited with 646·28 lb., and the Red Poll with 547·44 lb. fat.

THIRD-CLASS CERTIFICATES.

Third-class certificates issued during the year numbered 47, comprising 42 Jerseys, 4 Friesians, and 1 Shorthorn. The average of the Jerseys was 496·48 lb. fat from 8,668·4 lb. milk in 364 days, for the Friesians 707·04 lb. fat from 19,419·3 lb. milk in 365 days, while the Shorthorn gained a certificate for 411·61 lb. fat from 9,810·6 lb. milk in 365 days.

At the request of the New Zealand Dairy Breeds Federation it has been decided to withdraw all third-class certificates of record and to issue second-class certificates in their place. The issue of third-class certificates has been discontinued, and from the 1st January, 1937, there will be only two classes. The rules relating to the issue of first-class certificates will remain unchanged, while a second-class certificate will be issued to cows which comply with the rules for first-class certificate in all respects save period between calving for commencement of test and calving subsequent to test. Breeders concerned are being supplied with the necessary details

PERIOD BETWEEN CALVING.

The average period between calving for commencement of test and calving subsequent to test for the 490 cows granted first-class certificates in 1936 was 400 days, as compared with 404 days for the preceding year. The corresponding period for the second-class cows was 465, compared with 463 in 1935. The rules governing the testing allow a maximum period between calvings of 455 days for first-class certificate and 485 days for second-class C.O.R

Jerseys.

Class Leaders.

None of the Jersey records completed during the period under review seriously challenged the existing class-leaderships for the breed. Credit for the highest Jersey for 1936 goes to Reshure Nova Supreme, owned by Mr. H. S. Fleming, of Clevedon. Commencing test at the age of 6 years 307 days, Reshure Nova Supreme gained a certificate for 945·00 lb., fat from 15,147·4 lb. milk in 365 days. This cow is also the holder of a third-class certificate for a production of 1,007·42 lb. fat on a record commenced at 4 years 78 days. The present Jersey class leaders are as follows:—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Beechlands Summer Lass	A. Moreland and Sons, Te Rapa	1 343	275.5	365	15,467·2	899·25
Senior Two-year-old. Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old. Ivondale Silver Rainbow	P. J. Petersen, Waitara	3 327	309·7	365	15,073·4	950·63
Four-year-old. Woodlands Félicie	P. J. Petersen, Waitara	4 364	384·9	365	17,332·6	1,220·89
Mature. Holly Oak's Annie . .	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

Jersey Class Averages.

Certificates issued to Jerseys in the yearly division in 1936 numbered 418, as compared with 381 in 1935. The 418 certificates represented an average production of 505·13 lb. fat, being 6·60 lb. below the previous year's average of 511·73 The averages class by class for 1936 and 1935 are given in Table 3 :—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1936.		lb	lb.
Junior two-year-old	167	354	7,873·0	449·11
Senior two-year-old	40	345	7,862·1	452·47
Three-year-old	64	359	9,305·0	522·75
Four-year-old . ..	54	354	10,084·2	575·91
Mature	93	354	10,283·4	575·12
	1935			
Junior two-year-old ..	166	360	7,990·5	455·34
Senior two-year-old ..	40	357	8,988·7	499·60
Three-year-old ..	60	361	9,904·1	560·23
Four-year-old	42	356	9,900·5	564·92
Mature	73	358	10,435·2	576·13

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C O.R system in 1912 are given in Table 4 :

Table 4

Class.	Number of Certificates.	Average Yield for Season		
		Days in Milk.	Milk	Butterfat.
			lb.	lb.
Junior two-year-old ..	3,280	349	7,267·1	409·31
Senior two-year-old ..	866	346	7,926·0	448·13
Three-year-old	1,217	346	8,705·9	487·25
Four-year-old	853	348	9,285·6	519·75
Mature	1,976	347	9,598·5	528·74
All	8,192	348	8,323·0	465·30

Average test, 5·59 per cent

Jersey C.O.R. Bulls.

The names of 2,645 bulls are now included in the list of sires of C.O.R. Jersey cows, and of this number 542 have qualified for the C.O.R. bull class. A bull is classed as a C.O.R. bull when he has four or more daughters with first-class certificates, each daughter being from a different dam. Forty bulls have now qualified for the Jersey Cattle Breeders' Association's champion butterfat bull class, the qualifications for this class being as follows : Each bull must have five or more daughters which under first-class C.O.R. conditions have produced 520 lb. butterfat when starting test up to three years of age, 580 lb. when starting between three and four years of age, 640 lb. when starting between four and five years of age, or 700 lb. when five years old or over. It is not necessary for each daughter to be from a different dam. The corresponding standards for cows in the 305-day test are 460 lb., 510 lb., 560 lb., and 620 lb. butterfat respectively.

Friesians.

Class Leaders.

No changes took place in the Friesian class leaders during the year. The highest Friesian for 1936 was Moneville Sylvia Posch Mercena, owned by Mr. M. S. Rennie, of Mangere. This cow commenced test at the age of 5 years 36 days, and gained a first-class certificate for 838·77 lb. fat from 21,345·6 lb milk in 345 days. This is the third certificate gained by Moneville Sylvia Posch Mercena, her record of 764·09 lb. fat in the senior two-year-old class being a particularly fine performance.

The Friesian class leaders are as follows :—

Table 5.

Name of Cow and Class	Tested by	Age at Start of Test.		Fat required for Certificate.	Yield for Season.		
					Days.	Milk.	Butter-fat.
		Yrs.	dys.	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2	16	242·1	365	20,501·1	740·50
Senior Two-year-old. Pareora Echo Blossom	T. Sheriff, Clandeboye	2	223	262·8	365	22,671·9	819·81
Junior Three-year-old. Monavale Queen Bess	T H. Richards, Cardiff	3	56	282·6	365	21,609·3	800·18
Senior Three-year-old. Totara C.R Buttercup	Piri Land Co., Auckland	3	247	336·7	365	25,885·3	989·10
Junior Four-year-old Totara Veeman Lulu	Piri Land Co , Auckland	4	12	349·7	365	22,364·2	946·78
Senior Four-year-old. Totara C R. Buttercup	Piri Land Co., Auckland	4	267	375·2	365	27,108·1	1,079·14
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7	355	350·0	365	31,312·5	1,145·24

Friesian Class Averages.

Fifty-six certificates in the yearly division were issued to Friesian cows in 1936, this being the same number as for 1935. Average production

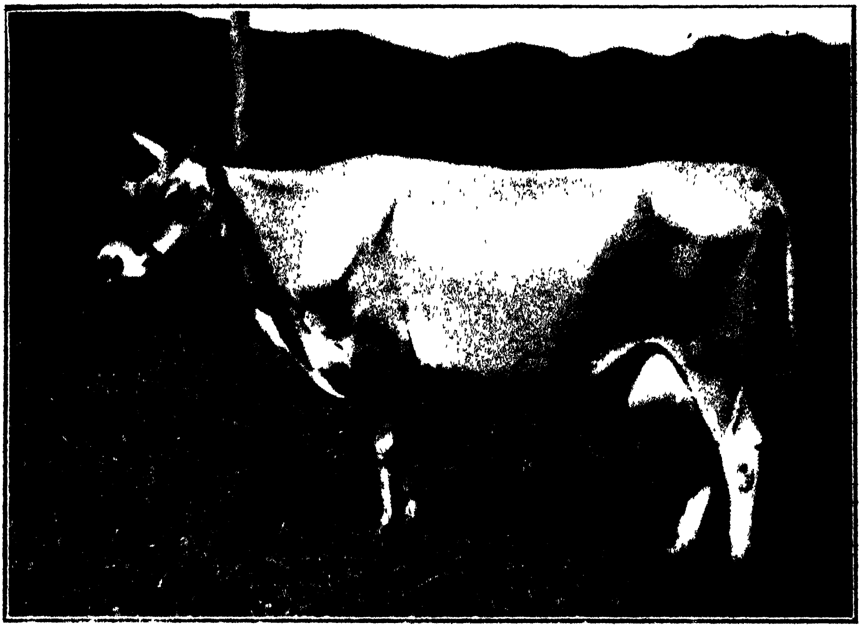

FIG. 1. PUNGA NUI JOYCE (D. YANDLE, OWNER)

New class leader in junior two-year-old class, 305-day C.O.R. test division: 10,122 lb. milk, 500·91 lb. butterfat. [*Exporter photo.*

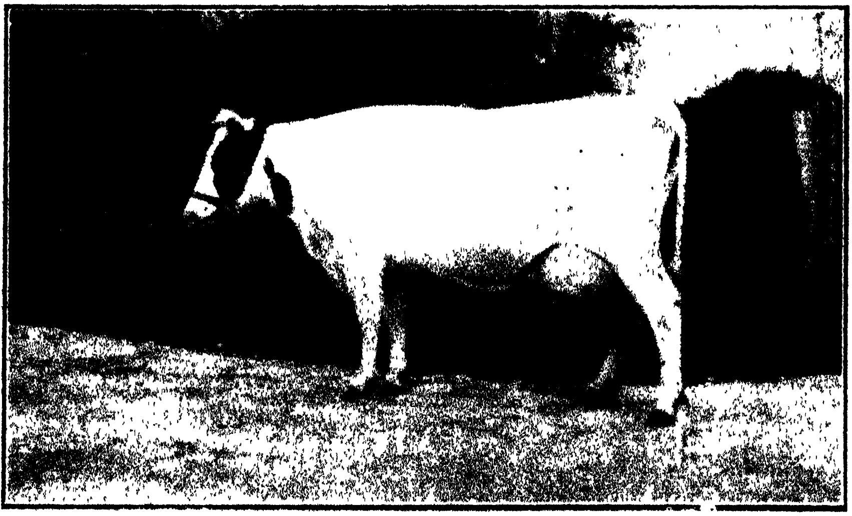

FIG. 2. MONEVILLE SYLVIA POSCH MERCENA (M. S. RENNIE, MANGERE, OWNER).

Highest C.O.R. Friesian, 1936: 21,345·6 lb. milk, 838·77 lb. butterfat in 345 days.

for 1936 worked out at 561·50 lb. fat, as compared with 563·95 lb. for the preceding twelve months. The Friesian class averages for 1936 and 1935 are as follows:—

Table 6

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1936.		lb.	lb
Junior two-year-old ..	20	351	13,240·8	459·98
Senior two-year-old ..	5	359	14,510·3	499·81
Junior three-year-old ..	5	365	14,937·2	575·51
Senior three-year-old ..	3	333	15,237·3	562·21
Junior four-year-old ..	2	353	15,379·0	620·71
Senior four-year-old ..	6	330	16,553·9	561·04
Mature	15	361	18,784·3	704·88
	1935.			
Junior two-year-old ..	18	305	13,446·5	479·04
Senior two-year-old ..	5	365	13,927·4	516·54
Junior three-year-old ..	2	305	16,880·7	691·17
Senior three-year-old .	7	321	15,773·9	550·08
Junior four-year-old ..	3	336	17,719·2	583·43
Senior four-year-old ..	5	334	16,429·7	587·15
Mature	16	350	17,281·1	653·57

The averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R. system in 1912 are given in the following table:—

Table 7.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	676	347	11,980·2	425·51
Senior two-year-old ..	276	349	12,849·5	457·85
Junior three-year-old ..	198	344	13,619·0	481·89
Senior three-year-old ..	201	337	14,183·6	509·34
Junior four-year-old ..	139	345	15,334·1	543·75
Senior four-year-old ..	142	346	16,229·5	568·36
Mature	613	343	16,241·3	574·00
All .. .. Average test, 3·54 per cent.	2,245	345	14,069·3	498·87

Friesian C.O.R. Bulls.

C.O.R. bulls in the Friesian breed now total 122, three new names having been added during the year. In last year's review the total was given as 120, but this should have read 119. Some 649 sires are represented in the 1,843 Friesian cows (including the 305-day division) certificated to the end of 1936.

Milking Shorthorns.

Class Leaders.

The Milking Shorthorn class leaders remain unaltered as the result of the past year's testing. The highest performance for the year for cows of this breed was put up by Bon Accord Nancy Lee, owned by Miss Rita Arnold, of Waimea West, Nelson. Commencing test at the age of 3 years 127 days the cow referred to is credited with 670·62 lb. fat from 14,077·2 lb milk in 365 days. The Milking Shorthorn class leaders are as follows:

FIG. 3 BON ACCORD NANCY LEE (MISS R ARNOLD, WAIMEA WEST, OWNER).

Milking Shorthorn of highest production in 1936 14,077·2 lb milk, 670·62 lb butterfat, as a junior three-year-old

Table 8

Name of Cow and Class	Tested by	Age at Start of Test	Fat required for Certificate.	Yield for Season.		
				Days.	Milk	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Matangi Quality 4th..	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Pinedale Beauty 4th	G. D. Hall and Son, Otorohanga	2 362	311·7	365	13,273·0	580·62
Junior Three-year-old.						
Matangi Quality 4th..	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Matilda 4th..	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old.						
Ashley Bank Winsome	Peach Bros., Sefton	4 298	378·3	365	17,687·7	730·93
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class Averages.

Certificates were issued to eleven cows of this breed in 1936, as compared with ten in 1935. Their average production was 456·44 lb. fat from 10,880·7 lb. milk in an average milking-period of 360 days. Two of the cows were in the junior two-year-old class, three in the senior two-year-old, one in the junior three-year-old, and five in the mature class.

The averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 are given in the following table :—

Table 9.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	58	349	8,406·2	346·25
Senior two-year-old ..	46	350	9,020·3	376·83
Junior three-year-old ..	29	337	9,750·7	398·70
Senior three-year-old ..	32	344	10,999·8	457·26
Junior four-year-old ..	26	350	11,097·5	454·38
Senior four-year-old ..	34	343	11,623·3	462·59
Mature	285	342	11,817·6	473·46
All	510	344	10,958·8	443·31
Average test, 4·04 per cent.				

Milking Shorthorn C.O.R. Bulls.

One new name was added to the Milking Shorthorn C.O.R. bull list during the year, the total now being sixteen. A total of 150 sires is represented in the 462 cows of this breed certificated to the end of 1936.

Ayrshires.

Class Leaders.

Four cows of the Ayrshire breed qualified for first-class certificate in 1936. The class-leadership list remains unchanged, being as follows :—

Table 10.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Maesgwyn Victoria ..	C. Morgan Williams, Kaiapoi	3 250	302·0	365	16,507·7	646·98
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Floss of Braeside ..	W. Moore, Homebush	7 287	350·0	365	20,305·5	832·72

Ayrshire Class Averages.

The averages, class by class, for all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 are given in the following table :—

Table 11.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk..	Butterfat.
			lb.	lb
Two-year-old	72	344	8,959·0	372·02
Three-year-old	40	347	10,028·0	413·26
Four-year-old	27	346	11,378·0	459·52
Mature	110	348	11,942·9	485·96
All	249	348	10,711·2	438·47
Average test, 4·09 per cent				

Ayrshire C.O.R. Bulls.

One Ayrshire bull qualified for the C.O.R. class during the year, bringing the total to 13, while 126 sires are represented in the 225 Ayrshire cows (including the 305-day division) certificated to the close of 1936.

Red Polls.

Only one Red Poll cow qualified for first-class C.O.R. during the year, being in the mature class. This cow's record did not affect the list of class leaders, which is as follows :—

Table 12.

Name of Cow or Class.	Tested by	Age at Start of Test.	Fat required for Certificate	Yield for Season.		
				Days.	Milk.	Butter-fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Wayward 6th B No. 1	G S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Waihou Pip ..	W. Jackson, Waihou	7 25	385·0	365	12,681·8	537·90

Red Poll Class Averages.

The averages, class by class, for all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 are as follows :—

Table 13.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	43	345	7,575·7	336·72
Three-year-old	16	346	7,905·1	349·63
Four-year-old	8	349	9,806·8	430·72
Mature	26	341	10,501·0	443·67
All .. .. Average test, 4·36 per cent.	93	344	8,642·1	376·93

Red Poll C.O.R. Bulls.

Twenty-eight different sires are represented in the sixty-nine cows of the breed (including one in the 305-day division) certificated to date. No new names were added to the Red Poll C.O.R. bull list during the year.

(2) C.O.R. 305-DAY TEST DIVISION.

Only 44 first-class 305-day certificates were issed during the year under review, 39 of these going to Jersey cows and 5 to Friesians. In addition, 2 Jerseys and 1 Friesian were granted second-class certificates in the 305-day division.

Jerseys.

Class Leaders.

The junior two-year-old was the only class which experienced a change of leader. In this class Mr. J. Murray's Erinview Moss, with 576·44 lb. fat, gives way to Mr. D. Yandle's Punga Nui Joyce, which raises the class-leadership record to 590·91 lb. fat. The class leaders are now as follows :—

Table 14.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Punga Nui Joyce ..	D. Yandle, Te Wera ..	1 349	250·5	305	10,122·0	590·91
Senior Two-year-old.						
Erinview Joan ..	J. Murray, Woodville	2 339	284·4	305	10,130·1	607·08
Three-year-old.						
Glendale Silver ..	A. Montgomerie, Kawhata	3 319	318·9	305	11,352·7	631·42
Four-year-old.						
Hatcliffe Lady Gay ..	H. J. Kaye.. ..	4 60	329·5	305	10,619·9	664·49
Mature.						
Hua Brook Perfect Lady	H. Salway, Bell Block	6 5	360·0	305	12,837·1	676·13

Jersey Class Averages.

The production averages, according to age class, of the 39 first-class certificates issued to cows of the Jersey breed during 1936 are given in Table 15. The average for all the cows was 450·89 lb. fat, and the average test 5·76 per cent.

Table 15.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	18	292	7,184·0	412·27
Senior two-year-old ..	3	305	6,924·0	402·84
Three-year-old	6	302	8,071·6	474·14
Four-year-old	5	304	9,095·1	521·01
Mature	7	305	8,705·9	500·80

Friesians.

Class Leaders.

There was no change in the list of Friesian class leaders, which remains as follows:—

Table 16.

Name of Cows and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Junior Two-year-old.		Yrs dys	lb.		lb.	lb.
Sealands Magpie Pietertje 2nd	H. G. A. Cameron, Weraroa	2 22	252·7	305	11,727·4	454·16
Senior Two-year-old.						
Rosevale Beauty Posch Griselda	E. H. Watson, Windsor	2 216	272·1	305	12,273·5	468·50
Junior Three-year-old.						
Totara De Kol Nina	Piri Land Co., Auckland	3 117	298·7	305	16,005·9	501·37
Senior Three-year-old.						
Sealands Alcartra Fobes	H. G. A. Cameron, Weraroa	3 304	317·4	305	10,407·8	389·04
Junior Four-year-old.	..	..	..	..	..	..
Senior Four-year-old.						
Ellerlea Aaggie Segis Minto	C. H. Steadman, Pokapu	4 357	359·2	305	15,311·9	557·71
Mature.						
Ellerlea Egie Segis Minto	C. H. Steadman, Pokapu	6 345	360·0	305	16,303·1	650·85

Friesian Class Averages.

The average production of the five Friesians which gained certificates during the year was 336·88 lb. fat from 8,698·8 lb. milk in 293 days. All were junior two-year-olds.

Thanks are again recorded to the various Breeders' Associations connected with the C.O.R. testing for their continued co-operation.

DIPPING MORTALITY ASSOCIATED WITH VIBRION SEPTIQUE INFECTION.

C. V. DAYUS, District Superintendent, Department of Agriculture, Dunedin.

THE provisions of the Stock Act require all long-wool or crossbred sheep to be dipped in the North Island between the first day of January and the last day of March, and in the South Island between the first day of January and the last day of April.

This enactment is provided as a means of exercising control in the infestation of sheep with external parasites, which tend to make sheep generally unthrifty, cause loss of blood from the animal, and damage the wool.

The common parasites in New Zealand are the "sheep tick" or "ked" (*Melophagus ovinus*) and three varieties of lice—the common biting louse, *Bovicola Ovis* (*Trichodectes sphaerocephalus*), the blue louse, *Linognathus ovillus*, and the leg louse, *Linognathus pedalis* (*Haematopinus pedalis*).

It is unfortunate, however, that a number of sheep are lost annually through carelessness in dipping, which is brought about in various ways. The majority of deaths occur through aspiration of the dipping-fluid into the lungs, thus setting up an acute broncho-pneumonia, or through a highly toxæmic condition due to infection with the organisms which produce blood-poisoning.

Other causes of mortality are chemical poisoning due to sheep actually swallowing the dipping-fluid, poisoning due to grazing contaminated pastures on which sheep have been turned without standing sufficient time to drain properly after dipping, death from exposure to adverse climatic conditions. If any extensive mortality from one or more of these causes is experienced, it is highly probable that there has been carelessness in the process of dipping, or in the management of the flock before and after dipping.

It is the purpose of this short note not to elaborate the reasons and means of prevention of all these causes of mortality, but to sound a note of warning in regard to one particular cause—viz., deaths due to infection with blood-poisoning organisms.

During the last few years it has been possible for me to inquire into several cases where a rather high mortality occurred in sheep after dipping from blood-poisoning due to the organism producing malignant œdema (*Vibrion septique*). In at least some of these cases infection took place from the dipping-bath itself, and it has been possible to recover the organism from the dipping-fluid, which was pathogenic for guinea-pigs. In fact, one sample of dip taken in April of last year still contains viable organisms pathogenic for guinea-pigs.

The common arsenical preparations made up into sheep-dipping fluids have little or no bacteriacidal action, and, consequently, it is easy to imagine how a dip which has become polluted by the passage of large numbers of sheep becomes a source of infection with an organism of which the soil is a natural habitat.

There comes a time when sheep put through this highly infected dip contract infection through skin abrasions due to recent crutching, dog-bites, rough metal in holding-yards, jagged timber and projecting nails in pens or races, and feed "scald." All these causes of abrasions, in my personal knowledge, have at some time or other been the means of infection being introduced.

It is important then to clean out the dip thoroughly at the commencement of the season and again if necessary more than once during the season according to the capacity of the dip and the number of sheep put through. This process should include the complete emptying of the dip, the removal of all debris, and the disinfection of the empty bath, yards, &c., with some suitable and economical antiseptic solution such as Kerol or Jeyes fluid.

In malignant œdema infection there is usually an area of skin highly discoloured often in the region of the brisket or running up inside the thigh, which is doughy to the touch, pitting on pressure, due to the tissues at the point of invasion becoming infiltrated with yellow or red serum. The muscle tissue becomes an intense deep red, and is softened. Breathing is rapid, and the temperature is raised, and the sheep soon becomes moribund.

Deaths usually take place thirty-six hours to forty-eight hours after dipping, and may continue until approximately the end of the fourth day after dipping.

All animals dying from this cause should either be burnt or buried deeply, without skinning or opening, and the area dressed with burnt lime. The disposal of the carcasses is very important, as the organism sporulates in the soil, which increases the concentration of infection if carcasses are opened up and disposed of indiscriminately.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 11th February, 1937, to 25th February, 1937, include the following of agricultural interest :—

No. 74394 : Flax-treatment ; J. H. Nightingall, S. H. McBurney, and H. Hewitt. No. 74941 : Cultivator-tine ; F. S. Worsnop. No. 75638 : Manure-distributor ; O. W. Willis and J. T. Ryan. No. 75045 : Emasculating implement ; L. Daroux. No. 75779 : Flax-treatment ; R. H. Millburn and H. G. Milburn. No. 75944 : Teat-cup ; Ronaldson Bros. and Tippett Pty., Ltd. No. 76661 : Milk-can ; C. R. McLean. No. 77215 : Manure-distributor ; Bamfords Ltd. No. 75579 : Milking machine installation ; A. B. Robertson and G. Allwood. No. 75680 : Ensilage grab ; S. R. Pilkington. No. 76562 : Determining sex of living organisms ; C. R. A. Chadfield. No. 77171 : Superphosphate treatment ; The Davison Chemical Corp.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid.

In this *Journal*, December, 1936, on page 323, appears the following statement : "Sutton's Sensation is merely an improved selection of Vilmorin's White-fleshed Purple Top (Hadfield and Calder, 1935)." Messrs. Sutton and Son's New Zealand agent draws attention to the fact that Sutton's Sensation Swede is a distinct variety bred by Messrs. Sutton and Sons, England, in 1928.

An order of the British Minister of Agriculture and Fisheries prohibits the landing in Great Britain of live poultry from any other country except Ireland, the Channel Islands, and the Isle of Man, except that consignments may be landed with a special license previously obtained and subject to special conditions regarding quarantine and disease-control. The order also makes similar provision regarding day-old chicks and eggs of domestic fowls declared to be intended for hatching.

LUCERNE IN THE WELLINGTON, TARANAKI, AND EAST COAST DISTRICTS.

C. J. HAMBLYN, Fields Superintendent, Department of Agriculture, Palmerston North.

IN two papers read by officers of the Department of Agriculture at the 1936 conference of the New Zealand Grassland Association, the growing of lucerne as a forage crop in districts of relatively high rainfall was dealt with. The area covered by the papers included the Manawatu and west coast from Paraparaumu to the Patea River(1) and Taranaki(2). During the subsequent discussion on these and other papers the present position and general trend in regard to lucerne-growing in the Wairarapa, Hawke's Bay, and Poverty Bay districts were also touched on. It is the intention here to review briefly some of the more important points in regard to the cultivation of lucerne in the southern portion of the North Island as discussed at the conference.

In general, while none of the area can claim to have climatic and soil conditions comparable with those of the great lucerne-growing countries of the world, there are in many of these districts conditions under which lucerne thrives and where the crop is of considerable value in providing an abundance of green, nutritious food during dry summers, and excellent material for hay for use in the winter months. Evidence was forthcoming to show that lucerne has during the past twenty to thirty years been tried out under practically all kinds of conditions of soil and climate in this portion of the Island, and that there has been a sorting of the localities in which lucerne can be established and maintained successfully, and where the crop fills a definite need in the farm.

Two outstanding features appear to be common to those areas where lucerne can be said to be an important feature of the farms, first, a freely draining subsoil, and second, dry summers, if not annually, then at least once in a while and frequently enough at any rate to bring out the value of lucerne as a green forage crop as compared with the pastures with which it has to compete for its place on the farm. Another feature which is common to lucerne-stands throughout the area under review, and which is a limiting factor in the life of the stands, is the favourable conditions during the autumn, winter, and spring for the growth of weeds and grasses which can seldom be dealt with at this period of the year by cultivation, owing to the moist soil conditions.

The general trend throughout the area is for lucerne to be concentrated in those localities where favourable conditions of soil and climate, as described already, occur together. Because sheep are less dependent on green fodder in dry summers than are the dairy cows, the largest area in the aggregate is to be found on the dairy-farms, though the stands are individually smaller than is the case on sheep-farms. There has been a definite and continued increase in the acreage of lucerne throughout the southern provinces, and there is still scope for extension. The problems in connection with the further utilization of lucerne can best be discussed by reviewing the position district by district.

Taranaki(1).—Of a total of some 4,800 acres in lucerne in Taranaki, practically the whole of the really successful stands are confined to the southern counties of Waimate West, Hawera, Eltham, and Patea, an area of comparatively low summer rainfall and occasional drought conditions. Here, however, the stands are comparatively short-lived owing to winter weed-invasion, and special attention to weeds in establishment and the use of autumn-sown oats or barley to smother winter weed and grass growth are considered essential to satisfactory lucerne stands. A falling-off of the area in lucerne during recent years in South Taranaki may be accounted for by the invasion by weeds and grass of the older stands and by the difficulty in utilizing the crops during comparatively wet summers. In North Taranaki the soils of the dairying belt are generally suitable to lucerne, but the good summer rainfall experienced is not favourable to the satisfactory maintenance and utilization of lucerne

Wellington(2). The area in lucerne has more than doubled during the past five years The position in the Manawatu and west-coast area of comparatively high rainfall, with, however, sufficiently dry summers, particularly along the coastal belt, to bring out the advantages of lucerne as a summer-feed producer, was dealt with in the conference papers(2). The best and most easily maintained lucerne stands are to be found on the freely draining sandy loams of the coastal belt, extending from Patea to Wanganui and beyond, with good stands also on the silts of the river-flats A considerable extension of lucerne areas is possible on the more recently consolidated coastal sand-dune country which extends from Paraparaumu in the south up to Wanganui and Patea. This belt, which is but recently being developed, extends for several miles inland, and lucerne is destined to play an important part, as the summer-feed supply is a difficult problem owing to the rapid drying-out of the sandy soils Lucerne can be successfully established and maintained, though the yield is not so high as is the case on the older consolidated sands farther inland Green summer feed is invaluable, however, and lucerne has proved its ability to fill the need for it.

The extension of lucerne-growing on the richer, free-draining silts of the extensive river-flats throughout the Manawatu and Rangitikei districts is a matter well worthy of the consideration of farmers on these lands. The ease with which lucerne grows, the heavy yield of high feeding-value, and the certainty of good summer production irrespective of dry spells are points strongly in its favour. In the Wairarapa during the past five years a very marked increase in the area in lucerne, especially in the southern districts, has been recorded. There is still a considerable scope for lucerne on the extensive areas of free-draining shingly and silty soils subject to severe drying-out in the summer. In many districts where the subsoil is stiffer and lucerne does not last, as a paying crop for more than five to six years, its value in dry seasons still is such as to warrant the establishment of a stand. A profitable stand under these conditions is one that produces three to four fair cuts a year for from four to six years. In the northern bush districts, with a higher rainfall, but suitable lucerne soils, occasional dry summers demonstrate the desirability of some lucerne on the smaller dairy-farms, and, in spite of difficulties with winter weeds and grass-invasion, the area in this crop is being extended.

Hawke's Bay District.—Of some 5,000-odd acres of lucerne in the Hawke's Bay District, by far the greater proportion is grown on the richer loamy silt soils of the Heretaunga Plains, where the stands are exceptionally prolific and remain productive for a long period. In more recent years the successful growing of lucerne by farmers in many other parts of central Hawke's Bay, and more particularly on the Takapau Plains and the lighter soils of the Tikokino and Norsewood districts, has been followed by a marked increase in the area in lucerne in these localities. A large proportion of the soils of Hawke's Bay are suited to lucerne, and though the invasion of stands by weeds and grass is a serious problem in the areas of higher rainfall, the summers are generally such that the value of lucerne is sufficient to warrant the establishment of stands on a much larger number of farms than it is on at present.

Poverty Bay.—In this district very favourable conditions are found for lucerne on the silts of the extensive river-flats round Wairoa, Gisborne, and the various rivers up and down the coast. A considerable portion of this country is devoted to dairy-farming, and it is on the dairy-farms that lucerne stands are found most useful, particularly in dry seasons. The area in lucerne in Poverty Bay has shown a steady increase in recent years, and there is scope for a much greater use of this crop, particularly on the lighter soils of the district.

SUMMARY.

Of a total of some 40,000 acres in lucerne in New Zealand, about 15,000 acres are grown in the area dealt with in this review. A steady extension of the lucerne area during the past fifteen years to twenty years, with a more rapid yearly increase in the past five years, is recorded. Good lucerne-growing areas are those with deep free-draining soils, the productivity of the stands varying with the natural fertility, and the satisfactory utilization of the crops and therefore the need for lucerne varying with the severity or otherwise of the dry conditions experienced on the average in the summer. The drier the summers the more need for lucerne and the better the conditions for harvest and utilization.

The useful life of stands is dependent on subsoil conditions, and, in this area, also on the possibilities of weed-control according to the amount and distribution of the rainfall.

Though the value of lucerne in the main recognized lucerne-growing belts has been taken advantage of to a fairly satisfactory extent, much more land could probably be devoted to lucerne with advantage on dairy-farms in suitable localities where the summers are particularly dry. Further, on extensive areas such as the Manawatu and west-coast sand-dune country, the Wairarapa Plains, Takapau Plains, and elsewhere, lucerne, because of its special value under dry-summer conditions could with profit be much more extensively used. Finally, experience has shown that lucerne is not really profitable on those extensive areas of country with stiff subsoils and generally high and fairly evenly distributed rainfall.

REFERENCES.

(1) ELLIOTT, A. G.: Paper read at 1936 Conference of the New Zealand Grassland Association.
(2) LONSDALE, T. W.: Paper read at 1936 Conference of the New Zealand Grassland Association.

LIMONITE FOR STOCK-LICK PURPOSES.

Chemistry Section, Department of Agriculture, Wellington

SAMPLES of limonite rock from the Okaihau quarries recently tested have been found to be very variable in cobalt content. Among the deposits being worked are some that contain over 250 parts per million of cobalt. To secure reasonable uniformity the company working the deposits is now selecting the rock so as to result in a product of anticipated cobalt content of 200 parts per million. A sample of such ground material ready for distribution gave a figure of 210 parts per million.

The Department of Agriculture has arranged for systematic supervision of the commercial samples of limonite offered for sale to ensure that the specified content of cobalt is satisfactorily maintained.

Recent experiments indicate that cobalt is the element present in limonites which is chiefly responsible for their beneficial effect when used as stock lick in bush-sick country.

Ruatangata limonite which has given such good results usually contains from 50 to 100 parts per million of cobalt, but it is quite probable that deposits of higher cobalt content may exist in this locality.

There are some indications that nickel, zinc, and perhaps other trace elements may exert a beneficial effect in addition to that of cobalt, so that it is impossible at present to evaluate a limonite for stock-lick purposes solely on its cobalt content. The determination of some of these trace elements in a variety of limonites is in progress, and the results will be reported later.

SEED-WHEAT CERTIFICATION.

FOLLOWING is a list of growers whose wheat crops have passed both the field and the grain inspections required under the Government scheme for the certification of seed-wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably tagged and sealed.

Variety.	Grower.	Acreage.
Cross 7	Allan, R. G., Windsor	10
	Blackwater Est., care of H. Neave, Leeston	17
	Foster, J. A., Springston R.D.	14
	King, L. R., Waipara	11
	Mills, Mrs A. J., Grovetown, Blenheim	11
	Sowden, F. G., Aylesbury	40
	Stewart Bros., Templeton	10
	Tutton, F. A., Springston R.D.	9
	Whyte, J. S., Pakakaio	22
Dreadnought	Brookes, J., Brookside	9
Hunters II	Rennie, W. O., Doyleston	13
Jumbuck	Bailey, P. V., Springston R.D.	20
	Rennie, W. O., Doyleston	4
Solid Straw Tuscan	Lambie, R. T., Leeston	20
	McLaughlin, D. W. S., Dunsandel	8
	Tutton, F. A., Springston R.D.	11

—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Autumn Management of Grassland.

BECAUSE exceptionally bountiful rains have been very widespread this summer, coarse mature woody herbage has been carried over much more extensively than usual from the summer period of heavy production. As a rule such coarse growth should be removed in the autumn: it delays the development of the fresh leafy condition which in the autumn characterizes pastures that have been well grazed throughout the year. If it is not practicable to employ store stock in the removal of the tall coarse growth, then it is likely to be advisable to remove it by "topping" with the mower. Apart altogether from the tall coarse growth of the pastures species, topping of pastures may be valuable to remove the aerial portions of shade-creating weeds such as docks, spear thistles, and willow-weed. If weeds of this type are not removed they tend to weaken greatly the pasture-plants in their immediate vicinity and to create vacant patches on which inferior plants later become established. When they are mown, however, they cease to create the shade which is harmful to valuable pasture-plants.

Autumn harrowing of pastures is a valuable practice which widely may be carried out advantageously in March on dairy-farms. A main benefit of such harrowing is the distribution of animal droppings which, when suitably scattered, are of considerable fertilizing value, but which, if not scattered, tend to bring about deterioration instead of improvement of the pastures and to increase the difficulty of carrying out fully efficient grazing. The thorough distribution of droppings that is desirable usually necessitates two harrowings; one harrowing at right angles to the other is more serviceable than two harrowings in the same direction around the field.

Top-dressing.

Many could profitably spend more on top-dressing of grassland than they are spending. Grassland of low productivity may often be made of high carrying-capacity by adequate use of fertilizers, provided the management is made appropriate to the changed character of the sward. In such cases the main questions the farmer has to decide relate primarily to additional stocking.

Firstly, before launching out on an increased top-dressing programme the farmer must be assured either that he can finance the purchase of the additional stock needed to cope advantageously with the increased production of feed or that he can otherwise dispose profitably of the feed by hay-making, by selling, grazing, &c. The crux of the position is that understocking may result not only in waste, but also in pasture-deterioration and in other undesirable effects. This has been well exemplified in the current producing season when the increased production of feed that has brought about understocking has been due not to top-dressing, but to the unusual abundance of moisture.

Possibly there has been too much tendency to consider top-dressing as a means to increased production: top-dressing certainly has caused much of the increase in our farm production during recent times; but on thousands of farms it now is the essential measure in avoiding decreased production. Hence a farmer who does not seek to increase his production may, nevertheless, need to top-dress more freely than he plans. The residual influence of previous top-dressing is particularly likely to mislead farmers to the unfortunate conclusion that their grassland is not being affected detrimentally by discontinuance of top-dressing. Instances have come under notice where farmers who have regularly been applying liberal dressings of superphosphate or other phosphates have discontinued top-dressing for a season, and for that season the carrying-capacity has not always been affected appreciably. But the immediate effect on the carrying-capacity is not likely to indicate the ultimate effect of not top-dressing grassland the productivity of which has been built up even partially by earlier top-dressing. This earlier top-dressing normally, under New Zealand practice in which phosphates dominate, creates reserves of fertility which represent part of the current capital value of the farm and management which does not provide for the maintenance of these reserves, simply involves living not upon income wholly but upon capital to some extent at least.

The opinion has been voiced in public authoritatively that about half our total production of butterfat may be attributed to an annual outlay of about £2,000,000 on fertilizers for top-dressing. As the value of the butterfat now produced annually approximates £20,000,000 (with butterfat at 1s. a lb.) it is clear that the dairying of the Dominion is receiving a handsome gross return for its outlay on top-dressing—a gross return which assuredly leaves an attractive net profit.

When only a portion of a farm is to be top-dressed it is, as a rule, advisable to select two types of fields for treatment. In the first place a special endeavour should be made to top-dress newly established pastures: it is likely to be more profitable in the long run to prevent, by suitable top-dressing, early deterioration of young permanent pastures than later on to renew or repair them when deteriorated. Secondly, and apart from young pastures, when only a portion of a farm is to be treated it is advisable as a rule to top-dress the fields supporting the better swards; then the effect of the fertilizer is exerted on a greater proportion of the better pasture-plants, which have a greater capacity of responding usefully to improved fertility than have the inferior plants or weeds which are more common in the poorer swards. For instance, more is accomplished by stimulating the growth of rye-grass or of cocksfoot than by stimulating that of brown-top or of rib-grass.

Despite the fact that there is widespread scope for profitable extension of the area top-dressed, it needs to be kept in mind that top-dressing is not always and necessarily economic. In short there are grassland areas on which top-dressing cannot be recommended This is true chiefly of land of relatively low carrying-capacity, and especially is this so when low prices prevail for the produce of that land. The converse of this is provided in the fact that the recently improved prices of wool and sheep has made top-dressing profitable on sheep-country where previously it was unprofitable. The position probably may be summed up in a manner useful for practical guidance by saying that the area on which top-dressing is not profitable at ruling market prices and on which "wet" stock are carried are exceptional, and a farmer should be sure his is one of these exceptional areas before he eliminates the assistance of suitable top-dressing from his farming.

Further, the potentialities of profit from top-dressing can be realized properly only when the top-dressing is judicious and available evidence points to the conclusion that at times top-dressing is far from judicious. Injudicious top-dressing arises in two main ways: sometimes funds are dissipated on top-dressing material from which little or no visible benefit has been noted, whereas often the funds could have been devoted to the purchase of other material which is known to give eminently economic results; sometimes the potential benefit from one fertilizing-material which is used is wholly or partially lost unless another material is used also, and in practice this second material is omitted. In liming the two phases of injudicious top-dressing are exemplified; sometimes lime is applied when there is no evidence that it is profitable to use lime, and sometimes lime is not used when phosphate is used and when that phosphate gives a poorer return than it would give in association with lime. The position in regard to potassic fertilizers is roughly similar to that in regard to lime.

For some years a survey of the response of grassland to these fertilizers has been progress and information regarding the response in specific areas is obtainable from local officers of the Fields Division.

In general, the first objective in top-dressing should be to increase the supply in the soil of phosphate available to the crop. The results in the field well justify the very general use of superphosphate, relative to which there are two facts which still seem not to be generally known: superphosphate does not cause any permanent increase in soil-acidity, and superphosphate is far from fleeting in its influence.

Over wide areas of fairly heavy rainfall basic slag is known to give uniformly good results, and in districts of good rainfall African and similar phosphates may be expected to prove satisfactory. Because of the variable visible results from district to district of both lime and potash it is really futile to make any general statements regarding them: the best course for those desiring guidance about them is to seek information from local officers of the Fields Division.

Wheat-growing.

In the main South Island wheat-growing districts spring-sowing should be carried out only when circumstances necessitate it—autumn and early winter are the ideal sowing-times. In the most southerly wheat areas and in the North Island spring is usually the most advisable sowing-season. Hunter's, Pearl, and Velvet definitely should be sown in the autumn or early winter. Solid-straw Tuscan may be sown both in the spring and in the autumn or early winter.

Wheat needs a fine but firm seed-bed. The advisability of firmness often makes it possible to grow wheat successfully without ploughing after peas or potatoes, the sowing of the wheat being preceded simply by two or three diskings. It is not desirable to work the surface soil down to a very fine condition, for fine particles have a tendency to "cake" at the surface, whereas small lumps break down gradually into a desirable fine loose surface, and in their early stages provide some shelter for the seedlings. When wheat is to follow grass or clover, skim-ploughing should have been done before these notes are published, and, if not, it should be treated as urgent work. About six weeks after the skim-ploughing, the surface should be disked to obtain a fine condition, and then ploughing to a depth of 6 in. should be carried out. When wheat is to follow oats or wheat the stubble should be first disked or grubbed, and, to obtain a fine tilth, should later be ploughed to a depth of about 6 in. When wheat follows grass or a cereal crop there is always danger of infestation by the grass-grub.

Extensive trials carried out over a series of years have shown that over a wide range of country quite a good profit results from the use with wheat of 1 cwt. of superphosphate to the acre, and the bulk of the wheat sown for some years with satisfactory results has been manured accordingly.

Measures of distinct value in controlling certain serious diseases of wheat should be made a routine feature of our wheat-growing. Further, these measures should be carried out properly, for, if they are not so carried out, they are likely to be ineffective, or, alternatively, at times to cause injury to the seed. The present trend in the treatment of seed-wheat is to replace wet pickles, usually solutions of blue-stone or formalin, by various substances used as dusts. Advantages of dusts are the absence of danger of injury to the seeds and the convenience due to the fact that dusted seeds keep well without damage, so that dusting may be carried out at any convenient time instead of being restricted to the busy time of sowing. Full information about the effective dusting of the seed of wheat and of other cereal crops is obtainable from officers of the Fields Division. The treatments of seed of oats and barley is just as advisable as is that of seed-wheat, unless it is quite definite that the crop is being grown only for green feed.

General Work with Crops.

Oats for winter and spring feed and subsequent grain-production should be sown not later than April or early May. Generally they respond profitably to the use of 1 cwt. to 2 cwt. an acre of phosphatic manure in which superphosphate is the dominant ingredient. The proved kinds of Gartons may be looked upon as the best all-round oats for the South Island. Gartons does not stand feeding-off to the same extent as Algerians, and should be fed-off once only and that feeding-off should be done quickly. Algerians, which are best when autumn-sown, are much used, with success, for green feed: they can be fed-off both in autumn and spring, and provide good chaff.

Quite often maize and millet grown for green feed suffer damage from autumn frosts. To avoid such damage these crops should be utilized during April, and preferably in the first half of the month. When abundance of other feed makes unnecessary the feeding to stock of these crops in a green condition, as is likely to be the position often this year, then they should be conserved preferably as silage.

Swedes which have suffered a serious attack of dry-rot should be fed off without unnecessary delay if they can be utilized to advantage.

Sometimes after the last cut of the season lucerne is grazed, and, in consequence of the trampling of the stock, the land is consolidated. The consolidation favours the invasion of the lucerne by weeds, including grass and clover. When it is desired to maintain the stand of lucerne as pure as possible, then late-season grazing of it is clearly inadvisable: it is especially so in districts of good rainfall in which weed-invasion is one of the worst troubles in lucerne-growing.

R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Spraying.

GROWERS are advised not to discontinue the application of arsenate of lead at too early a date. Codling-moth and leaf-roller caterpillar are usually still active, and it is therefore advisable to continue with the arsenical application until a few weeks prior to picking.

As the danger from black-spot infection is not yet passed, it is advisable to continue with fungicidal sprays for a while longer on susceptible late varieties of apples and pears. Where brown-rot fungus has been troublesome a careful examination should be made, and all mummified fruits removed from the trees and ground and destroyed by burning. In addition to this, an application of Bordeaux 5-4-50 is recommended, and should be made as soon as possible after the fruit has been picked, to assist in controlling the disease.

Orchardists should investigate thoroughly the results obtained during the season from the spraying-compounds used and the methods employed in preparation and application. When unsatisfactory results are obtained something is wrong. Factors which contribute to success are the thorough application of sprays at the correct times, use of the correct compounds, proper mixing of sprays, and an elementary knowledge of the life-history of pests and diseases.

Harvesting and Storage of Fruit.

During the coming weeks harvesting and storing of fruit will be engaging most of the orchardist's attention. Every endeavour should be made to pick the fruit as soon as it is ready. It is again necessary to emphasize the necessity for the careful handling of the fruit, as the percentage of damaged fruit arriving on the markets is much higher than it should be.

The result of careless handling is frequently not felt so severely during the earlier part of the season, when the fruit is sold immediately after it is picked, as it is with the later varieties, which are usually held for a time.

Fruit intended for storage should be most carefully handled and graded, and all bruised fruit or fruit with a broken skin and with other blemishes detrimental to the quality and appearance of the fruit should be rejected for cold storage. The graded fruit should be placed in the cold store as soon as possible after picking. A little trouble in the way of placing the various sizes and grades of fruit in the store so that they may be readily got at will save much inconvenience and additional handling when the time arrives for marketing the fruit. It is the practice of some growers to wrap the fruit when it is being packed for storage for the local market, which is quite good practice, except that it entails extra work if the fruit requires to be sorted before being placed on the market.

Fruit-export Work.

Despite the wet and cold season experienced throughout New Zealand, reports from several districts indicate that both apples and pears are maturing earlier this season, consequently, where this condition is observed, picking-dates should be advanced accordingly. It should be borne in mind that overmature fruit, if exported, cannot be expected to arrive at its destination in a satisfactory condition. Fruit that has passed the suitable stage of maturity for export, even though it may be packed some time prior to closing-date for the variety concerned, is certain to be rejected at the inspection. Any line of fruit that has reached the border-line between mature and overmature for shipment overseas should have the larger sizes withdrawn, and only the smaller sizes submitted for examination. Many varieties of fruit picked before the correct stage of maturity has been reached are inclined to wilt during transit, and fail to develop the true and full flavour of the variety. While the condition is to be carefully guarded against to maintain the good reputation of New Zealand fruit on the overseas markets, it is possible that even greater damage to the reputation of our fruit and lower market realizations would result from the export of overmature fruit.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus Culture.

Disease-control.—The season for spraying is not yet over. Temperatures will still be sufficiently high for the germination of the spores of verrucosis, and those who know the disease to be present in their orchards should apply Bordeaux 3-4-50 to their lemons, timing the application so that it is made when a fair proportion of the autumn blossom is just over full bloom. As the fruit is known to become infected only when it is small, it will not be advisable to delay the application for verrucosis-control until a month later, which time would most likely be more appropriate for a cover spray for protection from brown rot. The fruit forming at present will be harvested in the summer-time, and although it is generally the lighter of the two main crops it is more valuable for that reason. In the past a number of growers who have kept the main spring setting clean have overlooked the matter of protecting their autumn set of fruit, with the result that verrucosis has been prevalent and they have been unable to enjoy the benefit of the higher prices. It will be necessary to apply Bordeaux 3-4-50 to oranges and New Zealand grapefruit before the winter sets in. Where leaf-roller caterpillar is present, arsenate of lead powder, 1½ lb. to 100 gallons, should be added to this spray. Instances have come under notice of the foliage of newly planted New Zealand grapefruit trees becoming infected with verrucosis, so that young trees should receive attention where necessary.

The scale insects, particularly the red scale, and in some localities the various species of wax scales, will still need to be considered according to the prevalence of the pests and the specifics which already have been applied. Those who have decided that two applications of summer oil 1-33 are necessary should get the second one on during the period March-April, and those who have aimed at applying only one oil spray should also have the work completed by this time. Not only experiments carried out by the Government but also growers themselves have demonstrated that red scale can be eradicated provided that the job is done thoroughly. This needs three things—viz., an efficient high-pressure spraying plant; reliable, energetic, and determined operators; and the trees in such a condition that they can be sprayed properly. It is very pleasing to note that a considerable number of citrus growers have brought their spraying-apparatus up to date during the past twelve months, most of them having installed the piping-system with stationary pump and electric motor. Those who have not done so should seriously consider the matter, as competition in production is now so keen that only the efficient and up-to-date grower can hope to succeed. The cost of installing a spraying-outfit complete with shed, tank, motor, hose, piping, &c., may be worked out approximately as follows: £20 per acre for the first five acres, £10 for each additional acre. Costs are rising, so that those whose plants are inadequate should endeavour to finance new installations without further delay.

Pruning.—While the picking is light growers may find it convenient to pay more attention to pruning. Experiments carried out in America appear to prove that pruning, in the form of a methodical thinning-out of the tree as practised with deciduous fruits, reduces the yield and does not improve the grade or quality of the fruit. In spite of this, however, there appears to be a certain amount of work to be done, not as straight-out pruning, but more in the form of a touch-up here and there during picking operations. In addition to cutting back weak and spent wood to healthy foliage, some attention should be given to shortening of long spindly leaders and laterals. This will tend to obviate bad breaks, and, just as important, will lessen the amount of blemished fruit produced. The present need is for better citrus fruits, and while factors beyond the control of the grower, the weather for instance, cause some of the "rejects," there is still much that can be done to improve the grade of the fruit The year of heavy crops is naturally the best time to practise pruning by way of thinning, because during that year the grower will not miss the fruit taken off, while in a light-crop year he wishes to harvest all he possibly can. It is generally agreed that the poor keeping-quality of lemons at certain times of the year is due partly to the fact that they have taken too long to come up to size, in that by the time they are large enough to pick their natural life is nearing its end. This indicates that the tree carrying this fruit has not sufficient vigour to develop it all satisfactorily. The remedy, therefore, is to reduce the amount of fruit the tree is carrying by the judicious pruning mentioned above, with particular attention to eliminating "branch-rubs." Attention should also be paid to manurial and soil-condition requirements and if necessary to the control of disease.

Green-spot is a condition which causes a considerable lowering of the grade of lemons during several months of the autumn–winter period. The primary cause is bruising, brought about by rough handling of the fruit at some period during transit from tree to curing-room. The bruises are not very noticeable in the early stages, but show up after colouring. As the result of the bumps which they receive, the oil-cells at the point of impact are fractured and oil flows on to the surface of the rind, which at this point shrinks slightly, thus causing the oil-cells to stand out more prominently. If oil from a bruised lemon makes contact with an undamaged one, it causes a green spot at that point. Thus the number of lower-grade fruit is accentuated. As the typical green-spot does not show up until after the lemons have been in the colouring-room, the grower who supplies a central depot does not see the damage, a percentage of which happens in the orchard. Green-spot occurs most often when the fruit being picked is dark green. At this stage the rind is very tender and thus liable to damage. Later on when the bulk of the fruit coming up to correct size is silver or coloured the rind has toughened considerably. Although growers at all times should take great care in handling the fruit, one would like to emphasize the point that during the next few months, when large quantities of "dark greens" will be handled, even greater care should be taken to prevent blemishes due to rough handling.

Warning.—Growers generally are aware of the standard spraying practices and of the specifics which may be applied with safety in the working of their groves. In spite of this, new and sometimes ancient ones are being tried, some of which may be good while others may be harmful. It is in keeping with the progressive spirit of the age for one to make experiments in the orchard, but they should be carried out only in a very small way until these new practices have been proved safe and worthy of adoption on a large scale. Recently instances of severe loss have occurred in both young and old groves through the indiscriminate use of materials which have been harmful to the trees. Safety is the best policy where one's livelihood and capital are at stake.

—*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

Selecting Breeding-stock.

THE most important work of the year on all commercial poultry-farms is the selection of the breeding-stock for the coming season. If this work has not already been done no time should be lost in giving it the very best possible attention. So important is this work that no poultry-keeper can afford to miss any opportunity of making the very best possible job of selecting his breeding-birds. If this work is put off much longer it will be impossible to select all the best birds, as once a bird starts to shed its feathers those points which go to indicate usefulness mostly disappear.

The difference between the cost of production and the price received for poultry-products is often such that mistakes made with the selection of the breeding-stock may easily mean that the poultry-keeping may show a loss instead of a profit.

Disease is causing many poultry-keepers much concern, and unfortunately some have experienced considerable losses. Those poultry-keepers should take extra care in the selection of their breeding-birds. Quality not quantity should be the aim, and only the very best birds having good constitution should be selected. If this is done it will be found that the resistance of the young stock will be such that disease will have little dread for them. In fact, it may be said that the whole future of the poultry industry depends very largely upon the care taken and the skill shown by poultry-keepers in the selection of their breeding-birds.

The novice who has had little experience in the art of selection should endeavour to get some practical lessons from a successful person and then try his hand at selecting from his own flock those birds which he considers will make suitable breeders. After he has made his own selection he would be wise to get some experienced person to check over his work, point out where mistakes may have been made, and how improvements could be effected. The successful breeder or selector has not only the ability to more or less correctly gauge the value of the visible characteristics of his birds, but by years of careful selection and a constant study of the individuals of his flock he places himself in the best possible position when selecting his breeders to guard against those undesirable invisible characteristics which so often have such a disappointing influence on the progeny.

It is well to remember always that each bird possesses not only visible but numerous invisible characteristics, which may be transmitted to the offspring, and unless the selector has some knowledge of the pedigree of the stock he is selecting he is, to a certain extent, working in the dark.

A pure line of descent from parents that have been carefully selected for constitution, production, and breed characteristics is what is required. Every healthy purebred bird is capable of transmitting certain characteristics of its breed to its offspring, and the longer and more carefully the breeding-birds have been selected the more likely are those transmitted characteristics to be favourable. While a pure line or pedigree strain is so desirable, the great value and importance of individuality should never be underestimated. This point is mentioned because many beginners' plants have been visited where certain birds have been used as breeders just because they were brothers or sisters to certain competition or show winners. The results from such birds have, at times, been most disappointing, because they lacked that individuality or make-up of visible characteristics which is so necessary in a breeding-bird.

It is true that the secrets of heredity are, so far, well guarded, but there are some people who by a careful study of a particular breed and an almost uncanny ability or " gift " of selecting can detect those birds which have, in a marked degree, the power of transmitting good characteristics to their offspring.

These people have a natural genius in that particular line, and have by their natural ability been able to build up such a name for their stock that it is keenly sought after owing to its general high quality.

If it were possible for those of little experience or those who have had trouble with their birds to engage one of those " gifted " selectors to pick out their breeding-birds and only breed from such birds, it would be the very best way of guarding against disease and maintaining the good name this country has for utility stock. Though all poultry-keepers are not likely to become outstanding in the art of selection, as the natural aptitude for the work is possessed by few, still it is well for beginners to bear in mind that the art of selection can be cultivated, and if one is an enthusiast and is a keen observer he will soon find that those, together with a little practical experience, will enable him to make a very fair job of selecting his own breeding-birds.

The chief essential characteristics required in a good breeding-bird are purity of blood, vigour, constitution, and capacity to produce and reproduce.

The first step a poultry-keeper should take in order to become a successful selector and builder of a high-class strain or flock of utility birds is to acquire a knowledge of the standard requirements for the particular breed he intends keeping, for unless one has some definite standard to guide him much permanent improvement can hardly be expected. Like the carpenter who is asked to build a certain style of house, he must have plans and specifications to guide him.

The second step should be, when selecting, to heed that principle " like produces like," and always select those birds which show characters nearest to the model aimed at, for it is a fact that the offspring from purebred birds of the same breed are more likely to possess characteristics like their parents than those of other birds.

No doubt at times variations will cause disappointments, but all successful breeders have experienced such setbacks, but they are never discouraged by a few disappointments. It is really these numerous variations and more or less individual differences which do crop up that make the great art of selecting so difficult yet so wonderfully interesting.

The third matter, and perhaps the most important when it comes to actual picking of the breeders, is the body—its size, strength, and shape. Just as the life of any structure depends largely upon the strength of its foundations and frame, so also does the life and usefulness of a strain or family of birds depend upon the strength, type, and size of its individual members.

There is a tendency with some to place too little value on body-size, and rather too much on egg-records. While it is true that the medium-sized bird is often the better layer, it is well to remember that experience has proved that the best breeders are as a rule a little larger than the best layers, and that smallness is not the cause of great egg-production, but its effect.

At times some are inclined to be influenced too much by a nice comb or lobes, and, while it is most desirable to breed birds as near to the standard as possible, it is well to remember that the body is where the eggs come from, while the comb and lobes are furnishings.

It will prove better financially and otherwise to first pay the extra attention to the developing of good bodies rather than to developing good combs and lobes on poorer bodies.

The chief visible characteristics of a good utility bird are: Body will show length, depth, and width; a good crop-capacity and depth of abdomen; back rather flat, with width carried well back to the tail; the texture of the abdomen should be fine, silky, and flexible (a most important point); legs of medium length carried well back and wide apart; head fairly fine, showing strength and character, not coarse, but rather wide at the top, and of fair length; comb of medium size and thickness, not too small and not coarse or flabby; wattles of medium size, fine in texture, and carried close together; feathering hard, tight, dense, and often of a worn threadbare appearance at this time of the year; eyes large, bold, and prominent.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Autumn Management.

IN case all surplus honey has not been removed by the time these notes appear, beekeepers would be well advised to use bee-escapes, as indicated in last month's notes. There is a grave risk of starting robbing unless extreme care is exercised in removing honey so late in the season. However, the use of bee-escapes, with ordinary care, will enable his operations to be completed in comfort and without the interference of robber bees, which are particularly active at the close of the flow.

In some districts after the autumn rains a small flow of honey may be experienced, sufficient to meet the daily needs of the colony, with some to store for winter food. It is well, however, to make sure that the colonies have a sufficient supply of honey on hand to winter well; thus an estimate of stores should be made when the remainder of the surplus is taken. In most districts it is good practice to leave not less than 40 lb. of honey for each colony's requirements, while in some districts 60 lb. would be a safer estimate. It must be remembered that it is in autumn the beekeeper is laying the foundation for the next season's crop; therefore he should concentrate in wintering his bees well. The three main factors to be observed are strong colonies, abundance of stores, and queen-right hives.

As the season advances supers not fully occupied by the bees should be removed and stored away.

Uniting Colonies.

As advised last month, all weak and queenless hives should be united. The golden rule of modern beekeeping is to keep all colonies strong, and this applies specially to the autumn months, when weak colonies are in danger of being robbed. If by any chance late swarming and weak colonies from defective queens have to be dealt with, the procedure recommended is as follows: After taking the roof and mat from a queen-right hive, place a sheet of newspaper immediately over the top of the frames and carefully place the queenless colony on top. Little smoke will be required if the colony is gently handled. Weak colonies should be similarly treated. There is no need to remove one of the queens, as the bees will decide which they will keep.

Robbing.

Robbing is the result of carelessness, and once it has started is exceedingly hard to check. Do not expose honey, sugar, syrup, or anything that the bees can rob. See that the honey-house is bee-proof, and that all combs and vessels containing honey are removed to a place of safety. Contract all hive entrances, and especially guard against leaving hives open in a way that they can be attacked by robbers. All operations must be carried out quickly. If robbing has started it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the entrance and pile wet grass in front of the hive. This will usually cure mild cases of robbing, but where a colony has been overpowered by the robbers it should be closed altogether.

Care of Extracting-combs.

If proper care is not to be exercised in storing the extracting-combs when removed to the honey-house, it is far better that they should be stored in the hives. If the latter plan is adopted the mats must be placed on top of the brood-chamber, and the supers " tiered " above the mats. Unless the apiary is well sheltered, however, the hives must be weighted, as the winter gales will easily overset them when only empty combs are stored inside. It is far better to remove the combs if it can possibly be done, and thereby obviate the labour of lifting the supers if it becomes necessary to examine the brood-chamber. But in this case the combs should be properly housed to secure them from destruction by mice and wax-moths. It is not uncommon to find tiers of extracting-combs destroyed as the result of carelessness. Mice are especially destructive, and the damage they do in a short period is such as to render the greatest trouble worth while in preventing them from gaining access to the combs. The price of foundation now ruling is making it far more costly to produce combs, and if large numbers have to be annually produced the renewals become a severe tax on the season's profits.

During extracting many combs may become damaged, but the damage can be repaired by the bees when the combs are returned to the hives. As a rule, however, mice destroy the combs beyond repair, and no effort on the part of the bees can restore them to their original form. It is during the working-season that the beekeeper realizes the value of combs in securing a crop. A shortage of combs during the flow often prevents the bees being kept in working-trim, and leads to the production of honey being greatly restricted. Mice destroy the combs to gain access to the pollen, and render them foul and offensive to the bees.

In the absence of a mouse-proof room the combs can be stacked in supers "tiered" one above another. Be sure that there are no holes or cracks in the supers through which the mice can obtain an entrance. Place a queen-excluder at the bottom of the tier and another on the top. Queen-excluders, if used as described, are a complete success in preventing mice from destroying the combs during the off-season. Should the wax-moth be detected the combs must be fumigated. Bisulphide of carbon is generally used for destroying insect-life, but it should be used with great caution, as it is highly inflammable. It is far better when storing the combs at the end of the season to place a few moth-balls among them. This will be sufficient to prevent the attack of the moths.

Care of Equipment.

As soon as the honey has been disposed of, all utensils used in handling the crop should be thoroughly cleaned. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c. Wash carefully with boiling water, and dry thoroughly to prevent rusting. The high cost of equipment should impel the beekeeper to take great care in storing his plant during the off-season. It is advantageous to use loose washing-covers of close texture to cover the tanks and extractor. The covers will help to keep the utensils free from dust that is likely to accumulate during the winter. See that all metal parts likely to rust are given a good coating of oil. In season or out of season the watchword of the beekeeper in the extracting-house should be cleanliness.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE

Vegetable Crops.

ONE of the modern problems in vegetable-growing is the maintenance of a sufficient supply of humus in the soil under a system of constant and intensive cropping. In the past this has been done satisfactorily by applying heavy dressings of stable manure at suitable intervals. Such supplies are now not available, and, where no effective substitute is used the soil becomes, more or less, a dry lifeless dust, or, in wet weather, a sticky paste in which good crops may not be grown even with the most generous and well-considered mixture of artificial fertilizers. Even on the farm, in the warmer districts especially, little or no stabling is done, and well-cured animal manures for this purpose are scarce. On the lighter soils the problem of maintaining fertility is often best met by sowing down the land in grass and clovers, and grazing it for three years before breaking it up again for cropping for a similar period. On limited areas of high-priced heavy land this solution is not acceptable, and the question remains as to how this demand can best be met.

Where the land is adjacent to a sea-beach where seaweed sometimes accumulates, that material should be used, as its value for the purpose is comparable with stable manure. Unless, however, it is conveniently placed the cost of collection and carting may render this supply uneconomical. Poultry-keeping is sometimes practised partly with the object of obtaining a supply of manure, and the method is always worthy of consideration. In very many cases the supply of humus has to be maintained by means of an inadequate supply of farm and stable manure supplemented by grass and other vegetation which may be harvested in the vicinity and fermented down, together with such green crops as may be grown on the land and turned under.

To make a compost heap of the class referred to, select a situation that is inclined to be humid rather than dry, and remove about 1 ft. of soil from a strip about 8 ft. wide and as long as desirable, placing the soil equally along each side. In the strip so cleared build the stack about 5 ft. or 6 ft. high as the material becomes available. Any vegetable or animal material that will decay in a few months is suitable. Build the stack firmly with straight perpendicular sides and "damp down" any dry material. Fermentation will soon commence, and the temperature will be sufficiently high to destroy most injurious organisms. Top off the stack with grass and weeds mown before they seed, during the month of December, in odd corners and headlands. Wet it as may be necessary, and then cover with the soil which was removed from the foundation. This may be kept in place by logs placed along the edge of the top of the stack and wired into position. When more material again commences to accumulate start another stack. If fermentation is slow an occasional dressing of sulphate of ammonia and phosphates will hasten it if the material is kept moist.

As the main crops are now cleared the portion of land selected for planting early crops during the months of July and August should receive a dressing of manure which is turned under. If 4 cwt. or so of basic slag or bonedust per acre and the same quantity of kainit are worked in afterwards, the land should be in good condition for planting out salad and other crops in early spring. The kainit has the additional advantage of destroying slugs and other insect pests which are often troublesome at that season.

The remaining land as it is cleared, and so much of it as is not required for immediate cropping, may be sown down in Algerian oats, 1½ bushels, and horse-beans, 1 bushel, per acre; or Cape or black barley and vetches in the same proportions. These hardy crops in most localities will make good growth during the winter months, when the land can best be spared from commercial cropping, and provide in roots and tops considerable humus in the land when turned under to decay before further planting is done. They also have a beneficial effect in crowding out weeds and so cleaning the land. Such land will usually be in good heart for the growth of these green crops, but consideration may be given to the application of a moderate dressing of fertilizers with a view to obtaining maximum growth. On small areas white mustard is sometimes sown. The crop is comparatively light, but still useful: it suppresses weeds and helps to prevent the waste of nitrates which may otherwise be washed away if the land is left bare. It may be sown at a rate of about 2 oz. per square rod.

The tomato crop at this season is often slow in colouring owing to low temperatures. If mature fruit is placed in a temperature of 65° to 75° F. before or after packing it will redden perfectly. In a temperature over 80° red colouring is retarded. Light is not a factor in the operation.

Mushroom-culture has made considerable progress here recently. Beds 9 in. deep in sheds have given best results, and are also most economical with the limited supply of stable manure which is available. The main difficulty has been the control of extreme temperatures in summer and winter. To some extent it has been met by covering the beds with dry straw, but this method is inconvenient, especially where the beds are built in tiers to economize space. A well-built, insulated, and properly ventilated shed is no doubt the solution to this difficulty. It also facilitates the control of insect pests, &c., by permitting effective fumigation and excluding much reinfection if the ventilators are screened. Continuous cropping can only be maintained where the conditions are under control and scrupulous cleanliness is observed in all of the operations.

In a piece of clean, well-drained land the spring cabbage crop is now planted out. The plants should be set well down to the first leaves and the soil carefully firmed about the roots, especially when using a dibber.

Cabbage, cauliflower, and lettuce plants are often sown during the month of April for planting out in early spring. In the cooler districts the protection of a cold frame is required.

Small-fruits and Sundry Crops.

Trials of varieties of hardy fruits for commercial purposes were started at the Wisley Gardens of the Royal Horticultural Society, England, in 1922, under the administration of a representative committee, and examined at intervals by appointed judges. The most promising varieties were given a further test at sub-stations throughout the country. The first report was made in 1932, and the following are some of the outstanding results :—

Black Currants.—The position held by the four standard varieties (in order of ripening), Boskoop Giant, Seabrook's Black, Goliath, and Baldwin, is not immediately challenged. Daniels September is quite the best late-ripening currant, and in some districts may rival Baldwin.

Raspberries.—The three most satisfactory varieties in the trials were Lloyd George, Red Cross, and Pyne's Royal, with Norfolk Giant as the most promising late variety.

Red Currants. — Earliest of Fourlands, Laxton No. 1, and Perfection were the best of a moderate entry.

Gooseberries.—Leveller and Lancashire Lad are the standard varieties. Many entries were planted late and were not sufficiently established for judging commercial qualities at the time of the report. Leveller is a fairly vigorous plant of spreading habit, with large oval dessert fruit, yellow-green in colour, and practically smooth surface. A heavy cropper and excellent quality. Lancashire Lad is a large oval culinary fruit, dark red, with hairy surface when ripe, but useful for harvesting in green state. Growth upright in habit ; a heavy bearer.

Raspberry Lloyd George has been planted in many parts of the North Island, and has given great satisfaction, looking very much as if its triumphs elsewhere were to be repeated here. But it cannot be too strongly stressed that commercial plantings should be done only with varieties of small fruits that have been proved suitable for one's locality and market. The above lists, however, contain interesting suggestions for further trials in localities where fruit of this class is grown.

Crops of this class, harvested as they are about mid-summer, require a moist, well-drained soil for commercial cropping, gooseberries and red currants being to some extent exceptions. A somewhat open situation is also desirable, but in this respect black currants are the least particular.

The preparation of the land should now be completed as soon as possible, so that it may settle down well before planting commences. A generous dressing of manure, including perhaps blood and bone manure, trenched in or double-ploughed, will be suitable. When these crops are established only shallow ploughing and cultivation can be done without serious injury to the crop.

As regards spacing, much depends on the quality of the soil and the vigour of the varieties planted. Usually the distance between rows is 5 ft. to 6 ft., but in extreme cases 7 ft. to 8 ft., more especially for large plantations where the bigger implements are used. The tendency of late years has been to close up the distance between plants. Raspberries are often planted singly 1½ ft. to 2½ ft. apart in the row, and black currants 3 ft. For the first season or two the dwarfer vegetable crops can be grown in the alleys if first care is given to the welfare of the permanent crop.

On the farm a special area should be devoted to these crops with a view to providing supplies for the household. It would be most convenient if other permanent crops such as asparagus and rhubarb, also culinary herbs, &c., could be included. In this way the needs of the crops are best supplied, and the management is most economical.

Where nuts are grown the grass under the trees should be mown, or the surface otherwise smoothed out in the most suitable manner to facilitate harvesting. Then as soon as the nuts are ripe the trees should be well shaken and the nuts gathered, repeating the operation at intervals as may be necessary. Leaving the nuts on the ground exposed to dews and rain for but a short period depreciates the appearance and quality. Even when gathered promptly the nuts should be cured by drying them off well before storage. This is done in a well-ventilated shed or in the open, the nuts being placed in trays 6 in. or so deep with slatted bottoms, and well stirred from time to time. If curing is done outside, the trays should be stacked and covered at night to keep them dry. When cured the nuts should be put over a riddle to eliminate waste and under-sized specimens before marketing. Nuts required for planting should not be dried, but stratified in damp sand or sandy soil until they are sown.

The Homestead Garden.

In the flower-garden herbaceous plants now receive most consideration. Anemones, ranunculus, tulips, hyacinths, early-flowering gladiolus, are among the spring-flowering bulbous plants which are now set out; also wallflowers, polyanthus, pansies, &c., for a display at that season. These often take the place of summer-flowering annuals which are now going off. Sweet peas and other hardy annuals for spring flowering may be sown; also additions and alterations may be made to perennial herbaceous borders. The present time, indeed, is suitable for the periodical overhaul which is required to keep the herbaceous border in first-class condition, or that operation may be deferred until early spring.

In new gardens where the borders after subsoiling or trenching have been given shallow cultivation for a few weeks to destroy the crop of weed-seeds sufficiently near the surface for germination, and allow the ground to settle, herbaceous plants may now be set out. The effect is generally best when the group of plants of each variety is rather large. Border carnations deserve special consideration for this work in seaside gardens. In a well-drained open situation they flourish amazingly and are attractive in every way—foliage and flowers, colour, and fragrance.

Autumn-sown lawns have had good rains, and should come away strongly. When the grass is an inch or two high it should be cut when dry with a lawn-mower which is well lubricated and carefully set. It is generally best at this stage to raise the knife as high as possible and set it evenly and firmly. If cutting is repeated when necessary the grasses stool out and a good turf becomes established before the winter season.

—*W. C. Hyde, Horticulturist, Wellington.*

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ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

MORTALITY IN EWES AND LAMBS.

O. J., Apiti :—

I lose annually approximately 6 per cent. of my ewes before lambing with what I think is sleepy sickness and paralysis. Some also die without showing any symptoms of sickness at all. About 10 per cent. of the lambs are still-born or die shortly after birth. The balance of the lambs are very healthy, and fatten as well as any in this district. My farm is located in a cold district with very severe frosts, and the grass-growth in winter is very slight. I grow swedes and chou moellier for supplementary feed.

The Live-stock Division :—

An adequate feed-supply for your ewe flock during the winter months in your district is the most important factor in preventing the losses in the ewes at lambing, and also in ensuring the birth of healthy, strong lambs. It may be possible that a certain number of the ewes have not sufficient milk for the lambs at birth, and this may account for the main part of the 10 per cent. of lambs which die shortly after birth. In your locality I would suggest the continuation of your practice of providing swedes and chou moellier for winter feed, and, if possible, supplementing this with silage or hay if this is practicable.

CALVARY CLOVER.

W. F. S., Carterton :—

Which clover is " Calvary clover " ? Is it found in New Zealand ?

The Fields Division :—

Plants of white clover occasionally show red and reddish-brown blotches or markings on the leaflets, and sometimes patches of white clover so marked make their appearance in a pasture. These red markings were attributed to white-clover plants splashed with blood on Calvary it being held that the marks have become characteristic of white-clover plants descended from the original ones The name " Calvary clover " has persisted. White clover with such markings, growing in patches, is not uncommon in New Zealand.

THRIPS ATTACKING COCKSFOOT.

G. H. V., Banks Peninsula :—

What is the nature and the control of the thrips attacking cocksfoot ?

The Fields Division :—

The life-cycle of thrips commences in the egg stage. The eggs are laid either on the surface of the host plant or are inserted into the tissue by means of a sharp saw-like ovipositor. Following the egg stage there commonly are two larval stages, both of which bear a strong resemblance to the adult form in general appearance. A prepupal and a pupal stage follow next, during which time the animal moves but little and takes no nourishment. From the pupal stage the adult insect finally emerges. The time taken in completing the life cycle varies considerably for different species, and is also strongly influenced by temperature conditions.

The food of thrips consists of plant-juices obtained by breaking open the plant-cells by means of a chafing and rubbing action on the leaf or fruit surface and sucking the liquid contents with the cone-shaped mouth. In severe attacks the foliage becomes brown, dry, and brittle, and soon dies, the plants experience a severe set-back, and there is often a considerable reduction in production. Under field conditions control methods are largely lacking, but heavy rain is considered the best natural check.

WEATHER RECORDS: FEBRUARY, 1937.

Dominion Meteorological Office.

NOTES FOR FEBRUARY.

THOUGH there were no very violent storms, the weather during February was unsettled and very cold for the time of year. The total rain was much below normal in the northern and eastern portions of the North Island, but there was sufficient in most places to keep the soil moist. In Hawke's Bay and the Gisborne district, however, the westerly winds accentuated the rainfall failure, and dry conditions prevailed. Stock are generally in good condition, but have done rather better in the areas where the rainfall was low than elsewhere It was too cold for animals really to thrive well, and in much of the South Island the softness of the feed has led to various digestive troubles and considerable losses of lambs. The milk-yield is being well maintained. In Taranaki and the Manawatu the heavy rains were confined, principally, to a few days towards the end of the month, but in the South Island they began earlier and produced adverse conditions for harvesting, which has been delayed somewhat. In parts of Canterbury there are signs of sprouting of wheat in some of the crops. Several frosts were experienced, and these, combined with the general lack of warmth, were unfavourable to many small crops. Tomatoes, in particular, have suffered considerably. There is still an abundance of pasture, and supplies of winter feed are assured for most districts.

Rainfall.—In Taranaki, western Wellington, and the whole of the South Island with the exception of a portion of North Canterbury, the month was a very wet one indeed. Most of Taranaki and Nelson had between two and three times the normal rainfall, while in parts of Otago and Southland even greater departures were experienced. Hawke's Bay and much the greater part of the Auckland Province had very low totals. In the Wairarapa conditions were more varied, but the departures from average generally small.

Temperatures.—The month was one of the coldest Februaries as yet experienced. Mean temperatures were everywhere much below normal, the departures increasing from about 2 degrees in the far North to about 4 at Wellington and over most of the South Island.

Sunshine.—At most places there was less sunshine than usual, though where the rainfall was below average the sunshine differed little therefrom. Tauranga had 220·1 hours and Napier and Lake Tekapo each 218·8.

Pressure Systems.—The month began with a fine spell while an anticyclone passed slowly eastwards across the country. From the 6th to the 8th there came a series of westerly depressions, the effects of which were felt mainly in the South Island, heavy rain falling in western and southern districts. After a very brief interval a fresh and a very long series began to pass. As the first of these depressions, a rather intense one, approached on the 10th, north-westerly gales occurred in the middle portion of the Dominion. By the 11th winds had changed to west or south-west, and from that date until the 18th the winds from these directions continued to prevail, and were frequently strong. General rains occurred, with heavy falls over the South Island and about Wellington. From the 10th to the 14th the atmosphere was particularly unstable, and thunder and hailstorms were very numerous. Snow fell on the ranges, and there were a number of frosts during the period.

A fine spell followed, and the anticyclone previously mentioned finally moved eastward across the Tasman Sea and the Dominion. On the 23rd, however, another unsettled spell commenced. Again there was general rain, with very heavy falls from Taranaki southwards. Flooding occurred in Taranaki, western Wellington, the Waimakariri River, and in Otago and Southland.

RAINFALLS FOR FEBRUARY, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Fall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	4·00	14	1·06	3·50	12·47	7·44
Russell	0·84	4	0·41	4·24	17·94	8·33
Whangarei	1·65	10	0·54	3·87	12·29	7·80
Auckland	1·05	9	0·38	3·57	5·46	6·54
Hamilton	1·82	10	0·49	2·91	7·10	6·48
Rotorua	1.89	12	0·62	3·84	8·50	7·95
Kawhia	..	..	..	2·86	..	6·41
New Plymouth	11·24	14	4·64	3·94	15·48	8·12
Riversdale, Inglewood	17·01	15	5·53	6·03	24·98	13·54
Whangamomona	10·82	8	4·92	3·89	16·02	9·47
Hawera	7·12	12	2·40	2·40	10·20	5·91
Tairua	0·96	9	0·17	4·68	7·24	8·34
Tauranga	1·20	11	0·41	3·78	6·58	7·81
Marachako Station, Opotiki	1·15	11	0·30	4·14	11·58	7·73
Gisborne	0·73	6	0·37	2·46	5·88	6·18
Taupo	1·28	9	0·50	3·74	5·90	6·11
Napier	0·72	5	0.39	2·46	5·41	4·96
Hastings	0·11	5	0·04	2·25	3·12	4·18
Whakarara Station	0·91	7	0·20	..	7·20	..
Taihape	2·35	10	0·41	2·43	6·56	5·59
Masterton	2·76	13	0·87	2·78	6·90	5·34
Patea	6·83	11	1·86	2·40	10·90	5·99
Wanganui	5·23	9	1·35	2·42	8·46	5·25
Foxton	3·78	9	1·05	2·07	6·02	4·21
Wellington	4·22	11	0·99	2·75	7·40	5·64
South Island.						
Westport	10·72	17	1·67	5·35	19·65	13·55
Greymouth	11·00	18	2·10	6·21	26·30	15·38
Hokitika	13·84	16	3·42	7·22	28·20	17·32
Ross	14·16	16	4·05	8.90	34·65	21·30
Arthur's Pass	18·86	15	7·03	9·90	39·11	24·02
Okuru, South Westland	10·19	9	3·50	9·66	24·71	22·25
Collingwood	10·90	11	2·89	5·13	20·33	11·71
Nelson	5·43	11	2·83	2·63	7·52	5·53
Spring Creek, Blenheim	3·38	10	1·20	2·18	7·03	4·40
Seddon	2·10	8	0·72	1·85	5·69	3·69
Hanmer Springs	2·53	13	0·65	3·26	4·57	7·21
Highfield, Waiau	1·49	10	0·45	2·60	2·58	5·58
Gore Bay	2·26	12	0·76	2·80	3·56	5·26
Christchurch	2·19	16	0·76	1·56	4·27	3·89
Timaru	2·48	13	0·85	1·79	6·18	4·18
Lambrook Station, Fairlie	2·80	11	0·70	1·81	6·28	4·24
Benmore Station, Clearburn	2·73	11	0·61	1.62	8·23	4·39
Oamaru	2·13	12	0·78	1·79	4·40	3·83
Queenstown	3·78	12	1·39	1·97	7·64	4·84
Clyde	2·68	10	1.26	1·06	4·28	2·91
Dunedin	7·15	16	2·02	2·71	10·46	6·12
Wendon	7·56	20	2·09	2·26	12·46	5·46
Balclutha	6·78	19	1·84	1·99	9·13	4·30
Invercargill	5·88	21	1·35	3·18	10·26	7·18
Puysegur Point	12·68	21	2·50	5·74	20·57	13·36
Half-moon Bay	5·54	18	0·69	4·08	12·75	8·90

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FARM FORESTRY.

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ADEQUATE shelter, shade, and timber plantations are extremely valuable on a farm. Shelter is necessary on a farm for the protection of stock, pastures, and crops. Perhaps the most important point in this connection is the protection of the surface of the ground from the effects of harsh, drying winds. This is particularly noticeable on western and southern slopes in early spring. Grass pastures are to a large extent dependent on the moisture held in the surface layers of the soil, and well-sheltered fields do not lose as much moisture by evaporation as ones exposed to the full force of the wind. Shelter is also very necessary for live-stock during cold and wet weather Less food is required by stock to maintain their body temperature when sheltered than when exposed to cold winds. Shelter is also required for ewes lambing where the spring weather is apt to be cold.

Shade for stock is very desirable during the hot summer weather. Dairy cows especially benefit from shade, and milk better where shade is provided. Sheep and lambs revel in shade, and lambs being raised for export come to maturity much quicker. Shade is also essential for successful pig-raising, a phase of pig-farming that many farmers do not appear to have realized when laying out their yards.

Good fencing posts, battens, and rails are becoming, in most places, very expensive. Waste parts of the farm can be very profitably planted in quickly growing timber-trees that will yield quite good returns.

Plantations and hedges add immensely to the appearance of the farm and the countryside. Indeed the value and beauty of the farm can be increased by an inestimable amount by well-organized and judicious shelter-planting.

No hard and fast rule can be laid down in respect to the varieties of trees to plant for shelter. This is a purely local matter and must be governed by information gained through observing the varieties that do well in any particular district. Consideration must also be given at the outset to the result required—whether shelter only, or both shelter and timber. The practice of planting trees in single lines, with few exceptions, is ineffective unless the farmer is prepared to maintain them by systematic topping and trimming of the sides.

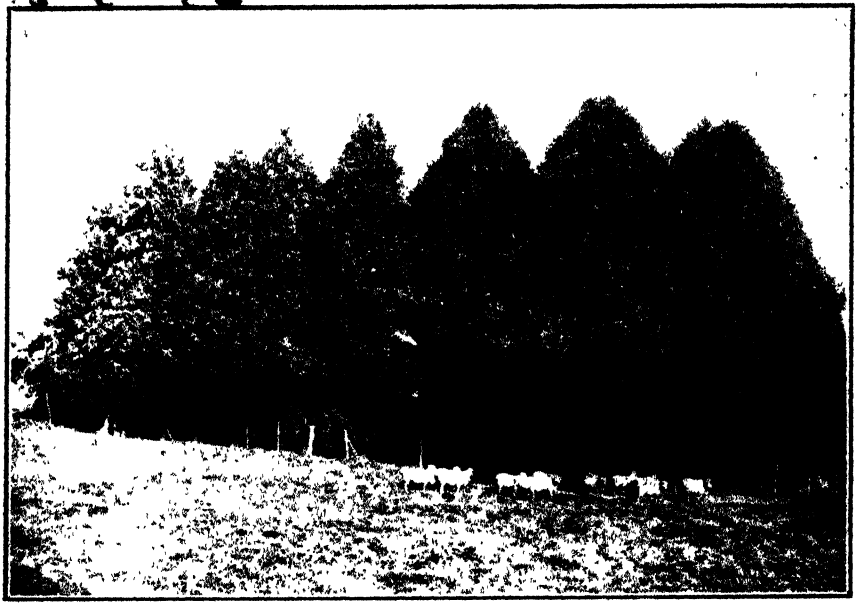

FIG. 1. A CLUMP OF CUPRESSUS TOROLOSA PLANTED IN THE CORNER OF A FIELD.
Lambs on the sheltered side.

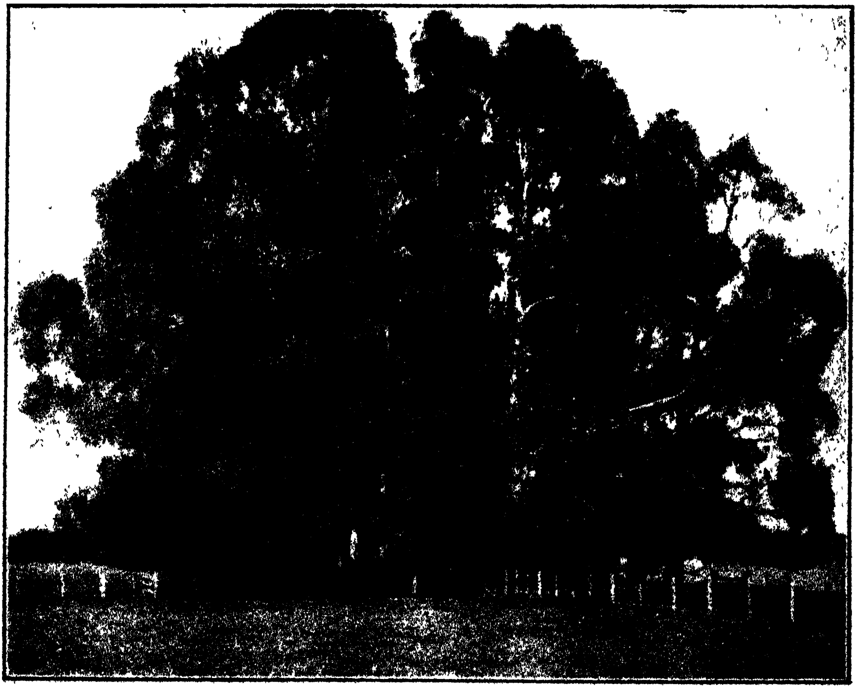

FIG. 2. A CLUMP OF EUCALYPTS (MACARTHURI) IN THE CORNER OF A FIELD PROVIDING SHADE AND USEFUL FARM TIMBER.

Unless topped and trimmed many single rows of trees such as *Pinus radiata*, *Cupressus macrocarpa*, &c., become bare about their trunks, and heavily side-branched above. Shelter such as this cannot stop the ground wind, but causes draughts, and stock are better in the open than

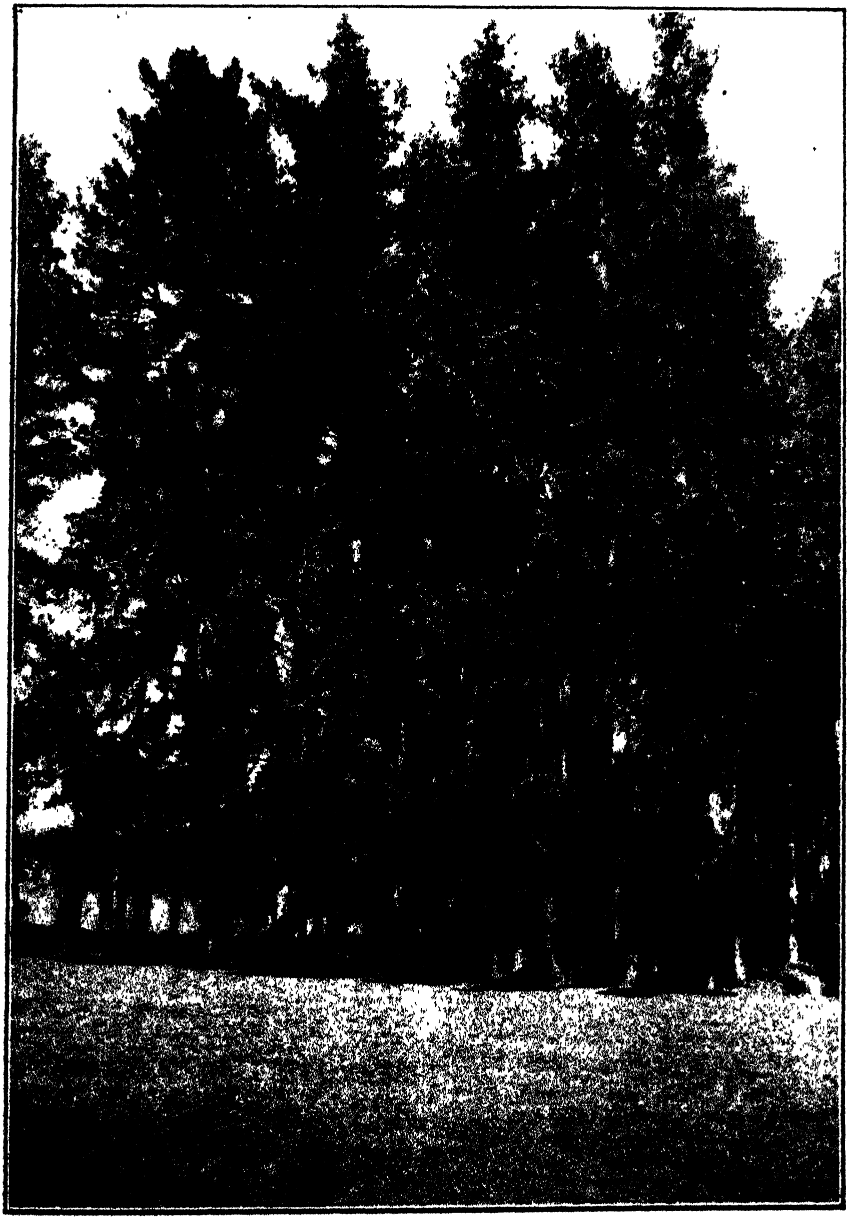

FIG. 3. PINUS RADIATA GROWING IN A ROUGH CORNER OF A FIELD.

Many of the trees have reached the stage when they should be cut out for milling.

near such belts. Excellent trees for single-row planting, provided they are protected from stock, are *Cupressus Lawsoniana*, *Cupressus Benthamii*, *Hakea saligna*, and *Pinus radiata*. These trees are all the better if they are topped when they reach a height of 12 ft., and cut back every year or every second year thereafter. It is also better to shorten side branches. This topping and trimming takes time, but it is time well spent.

GENERAL NOTES ON SHELTER-PLANTS.

The following notes give brief information about well-known shelter-plants :—

Cupressus Lawsoniana, recommended for soils of a free nature and well-drained alluvial land. Does not flourish in heavy water-logged land or clay land that is inclined to be wet during the winter. For hedges (intended to be trimmed) plant 3 ft. apart. For tall break-winds plant 6 ft. to 7 ft. apart. Plant two-year-old trees.

Cupressus Benthamii.—A much faster-growing tree than *Lawsoniana*. Will grow in all soils where *Lawsonianas* thrive, and will stand moister soil conditions. Not quite so good as *Lawsoniana* for the production of a closely trimmed hedge. For tall shelter plant 6 ft. to 7 ft. apart.

Pinus radiata.—One of the fastest-growing trees. Will grow in most soils and situations. If desired for a tall hedge, must be trimmed annually.

Hakea saligna.—Does well in heavy clay lands, particularly the gum lands that lie wet in winter. Recommended for such places as the clay lands around Auckland, North Auckland, Te Kauwhata, &c. Also does well on the Waihi Plains. Apparently does not do really well on limestone country. Plant 3 ft. apart. Requires rough trimming once a year to keep it in order.

Acacia verticillata.—Will do well in clay country and especially that overlying limestone. Plant 1 ft. 6 in. apart in late August or September so as to escape any frost for the first year. Keep well trimmed after the first season's growth. This hedge will attain a height of 4 ft. 6 in. in two years. It makes a good cattle hedge, but is not recommended for sheep-farms owing to the spines or prickles becoming embedded in the sheep's wool.

Barberry (Seedless Variety).—Makes a good hedge on almost any soil and in most situations. Must be trimmed annually to keep it in order. Plant 1 ft. 6 in. apart.

African Boxthorn.—Recommended for planting as a stock-hedge near the coast where other hedge-plants will not grow. Trim annually, and be careful to burn all trimmings to minimize the danger of injury to the feet of cattle.

The planting of main shelter-belts to arrest bad winds is a totally different matter, and requires more consideration on the part of the planter. In this case single-row planting is never altogether satisfactory. At least four rows of mixed trees are recommended. A first-class belt can be made up as follows :—

Two rows of *Pinus muricata* planted 4 ft. apart each way on the windward side,
Two rows of *Pinus radiata*, 6 ft. apart each way,
One inner row of *Cupressus Lawsoniana* or *Cupressus Benthamii*

according to soil, planted 12 ft. from the *radiata* and 3 ft. apart in the row. The row of *Cupressus* to be kept trimmed. On land not suitable for *Cupressus*, *Hakea saligna* or barberry may be planted instead. The *Pinus radiata* being of quickest growth soon reaches a fair height, and should be topped at 20 ft. Attention should be given to topping every second year thereafter.

For coastal districts subject to salt-sprays, provided the land is not wet, the following planting is recommended, grown as a tall belt :—

One or two rows of *Pinus pinaster* fronting the sea, 4 ft. apart each way.
One or two rows of *Pinus muricata*, 4 ft. apart each way.
Four rows of *Pinus radiata*, 6 ft. apart each way.
Two rows of *Cupressus macrocarpa*, 6 ft. apart.
One row of *Cupressus Lawsoniana*, *Hakea saligna*, or barberry planted as a hedge, 15 ft. from the macrocarpa. This inner hedge to be kept trimmed.

In districts not affected with salt-sprays another effective breakwind that will provide both shade and shelter is a single row of either macrocarpa or eucalypts, with a hedge of barberry planted on the eastern side in the case of the former and the western side in the case of the latter. With the macrocarpa the barberry should be planted not less than 15 ft. away, and about 9 ft. from the gums. Even then the macrocarpa should be kept well cut back on the side next to the barberry, or it will overshadow it, making it thin and weak in the foliage, and so spoiling its purpose as a draught-arrester. Eucalypts can safely be planted closer to the barberry, owing to their more open and upright growth. A good gum for this type of shelter is *Eucoxylon* (var. *rosea*) Campbell's gum. It is a fairly quick grower, fairly bushy, and does not grow too tall, and stands cutting back.

In wet situations where other trees do not grow satisfactorily, the Lombardy poplar provides quite a good shelter. Four rows should be planted, allowing 4 ft. between the rows and 4 ft. between the plants or cuttings. When the trees have attained a fair height, a good plan to keep the belt furnished at the base is to cut one of the side rows down during early spring. This will cause a dense bottom growth the following summer. During the next year the other outside row may be treated likewise. The resulting growth then provides an impenetrable wind barrier. The Lombardy poplar may also be used successfully in semi-dry areas where the soil is of a fair depth and somewhat loose nature.

The storm which was experienced in this province during February, 1936, revealed many weaknesses in shelter-planting. Trees which were considered resistant to salt-spray were badly blasted, even miles inland. Remarkable instances of this can be seen on both coast-lines to-day. Even in the Bay of Plenty eucalypts and many other varieties of trees were badly blasted. *Pinus radiata* in many localities is very sickly, whilst right alongside can be seen *Pinus muricata* absolutely unaffected.

The cyclonic force of the wind uprooted many shelter-trees, especially tall single- and double-row plantings of timber gums alongside drains. This is particularly noticeable in districts where the permanent water-level is from 4 ft. 6 in. to 6 ft. from the surface. Eucalypts planted for shelter and timber purposes and grown to a height of 50 ft. to 60 ft. in twelve to fifteen years have suffered badly.

Farmers having extremely tall trees on drain-banks in exposed situations on such country are advised to fall every alternate tree, and allow the young growths from the stumps to develop. When such growths are 10 ft. to 12 ft. high, thin by cutting out a number, and the balance top down to 8 ft., and then maintain them at a height of 12 ft. to 15 ft. by topping annually. This practice provides excellent ground shelter for stock for a long distance out into the fields. Two years after falling the first half of the trees, the balance of the large trees should be cut down and the young growths from the stumps allowed to come away and be thinned and topped when ready. By adopting this plan very efficient shelter is obtained and the risk of having many chains of tall trees uprooted during some future violent gale greatly minimized.

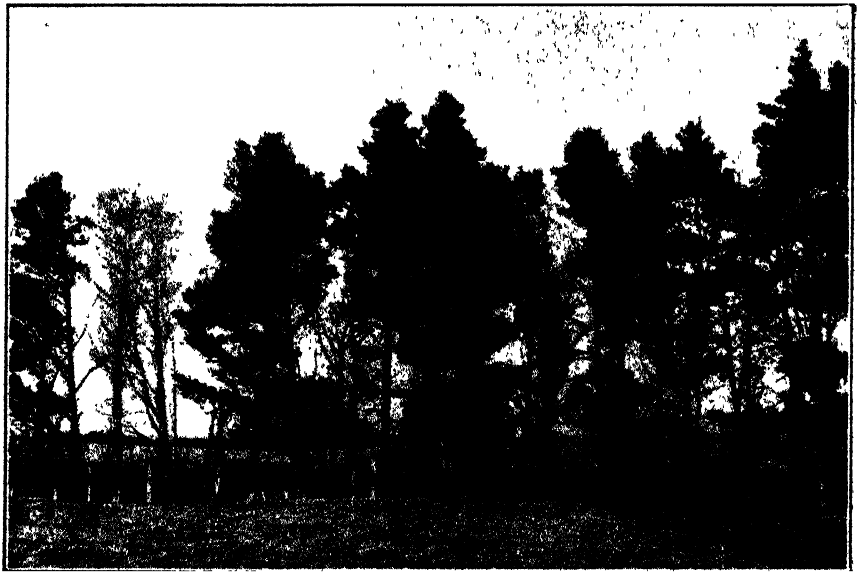

FIG. 4. PINUS MURICATA (DOUBLE ROW) PLANTED ON COUNTRY THAT HAS PROVED UNSUITABLE.

Note how bare the trees have become in the base, and how a large number have died out. Planted too closely together when set out.

On the average farm there are to be found odd corners and rough hillsides which it is impossible to crop or maintain in profitable pasture. Such areas should be planted with a suitable kind of tree to provide timber and wood later on. For rapid growth two trees are outstanding—viz.: *Pinus radiata* and macrocarpa; possibly macrocarpa is the more useful. In wet sodden soils it does not succeed. . If planted for timber purposes in fairly large areas, the plants should be set 6 ft. apart on the square or quincunx system, and after a few years every other tree should be cut out. This treatment causes the trees to grow up straight with clean barrels which provide timber for all classes of farm jobs. Consideration should also be given to planting a certain number of eucalypts. They grow in soils where macrocarpa fail. Varieties such as *Eugenioides*, *Viminalis*, *MacArthuri*, *Obliqua*, *Pilularis*, and *Leucoxylon* are recommended.

Nothing looks more effective on a farm than small clumps of trees, especially if planted on hill-tops. Even single specimens planted in large fields add to the beauty of the landscape, and provide shade for stock in hot weather.

Fencing will have to be provided in all instances where shelter is planted. This is, of course, the heaviest expense in any planting-scheme, but must be faced if success is to be assured.

SHELTER AROUND THE HOMESTEAD AND OUTBUILDINGS.

It is advisable to plant shelter around the homestead to check cold bleak winds, but care must be taken not to plant large trees too near the buildings and gardens. Whilst they are small they arrest the wind and do no harm, but after a few years their stems become bare, cold draughts drive through them, their large branches cast a shade over the homestead area, while their far-reaching roots invade all garden space. Homesteads so planted are rendered damp, cold, and unhealthy.

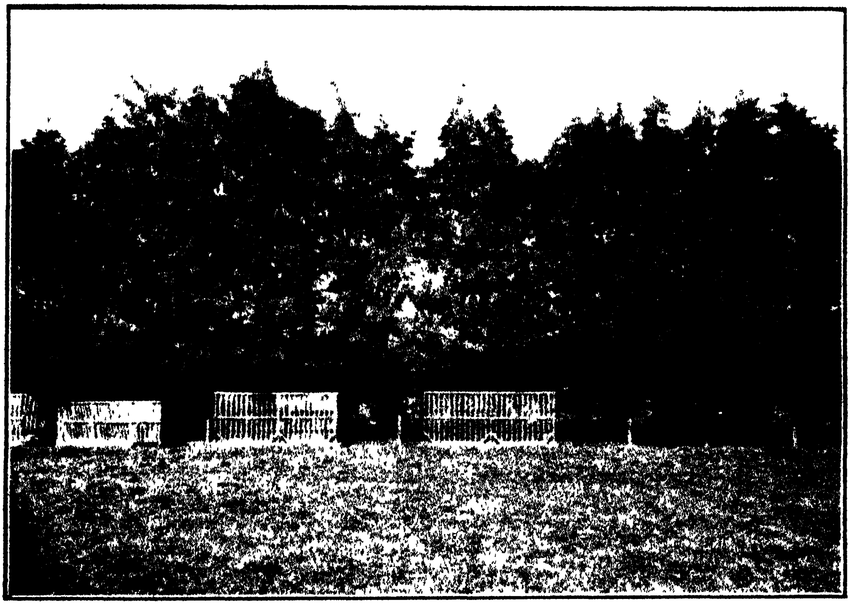

FIG. 5. SINGLE ROW OF CUPRESSUS BENTHAMII.

This shelter has been ruined through lack of attention. Note how bare it is at the base. The fence was erected too close to the trees and cattle have destroyed the lower branches. The fence should have been placed farther out and the ends of the side branches suppressed by slashing back. The trees should also have been topped. The taking of 4 ft. or 5 ft. off the top at this stage would improve considerably this single-row shelter.

In most districts of the Auckland Province where the homestead area is unsheltered, some quickly growing shelter is required, and *Pinus radiata* planted at least 1½ chains away on the windward side and kept trimmed is probably as good as any other tree. When planting *Pinus radiata* provision should be made to establish a slower-growing and better-class hedge on the lea side fully half a chain from the *Pinus radiata*, which can be cut down when the inner hedge is sufficiently high to shelter the homestead. Ornamental trees and choice shrubs of a tender nature can be planted with safety as soon as there is shelter. Extreme care must be taken, however, not to plant anything of a tall nature near the house: low shrubs should be nearest the buildings, and shrubs and trees of greater height near the hedge.

Pinus radiata plants are usually sent out as one-year seedlings in bundles. Other pines, Douglas fir, redwood, and *Cupressus Lawsoniana* are best obtained as two-year-old transplantings. Eucalypts and *Cupressus macrocarpa* are now usually sent out in trays as one-year-old seedlings. The trays are carried out and put near the pits, and the trees balled out from the trays as required.

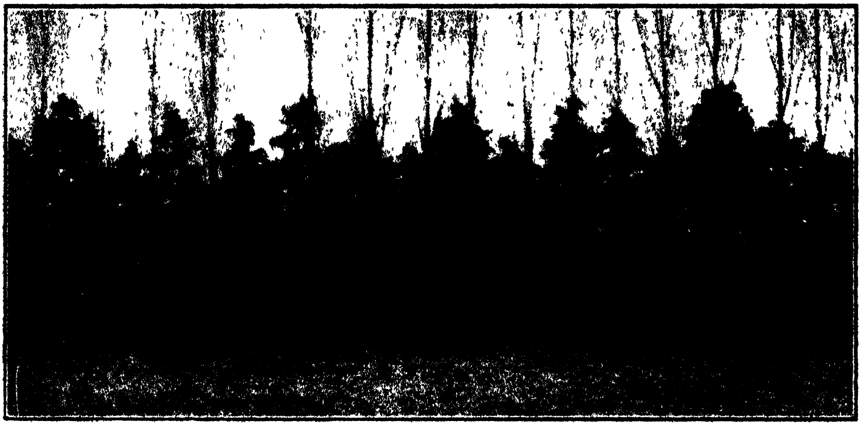

FIG. 6. TWO-ROW SHELTER.

Lombardy poplar 4 ft. apart, and *Cupressus Lawsoniana* planted between and 4 ft. away from the poplars. This shelter has reached the stage when the poplars should be topped at the height indicated in the illustration in which several feet of upper growth are not shown. The *Lawsonianas* would be improved if they were evened up on top and the fence moved farther out into the field. Stock are commencing to destroy the lower branches.

The time of the year to plant trees depends on the climatic conditions chiefly, and to some extent on the variety and age of the young trees. In the Auckland Province planting may be commenced in April, as soon as the soil is moist enough, and should be completed by early September. It has been found that trees planted before the end of May generally give the best results. Planting in mid-winter—June and July—should be done only with the hardy conifers. In districts where severe frosts are experienced, planting must be left until spring, from early August till mid-October.

In planting on the farm the greatest care should be taken in the preparation of the land, and every chance given the young trees to make rapid and early growth. If it is intended to plough the land, the ploughing should be done in summer and should be followed by the usual horse cultivation to keep weeds in check during the autumn. On unploughable land the pits for the trees should be prepared in autumn. The extent to which the land should be cleared depends on the nature of the weeds or scrub growth present. Most trees are naturally fitted to establish themselves on the forest floor, and so a certain amount of shade is beneficial. Growth such as light bracken-fern should as a rule not be burnt off, but left to provide shade and shelter for the young trees. Strong growing gorse, broom, manuka, &c., should be slashed down. On ploughed areas the lines of trees may be marked out with a garden line, while in unploughed and scrub areas the tree-locations may be defined by setting up pole-lines 6 ft. apart and by digging the pits along these lines. These pits are made by skimming off with a sharp mattock the turf or other matter over a circular patch roughly 18 in. in diameter and then loosening the soil as deeply as the mattock can be driven in. If it is intended to plant large-rooted or balled trees, a spadeful of earth should be removed and placed beside the hole. In districts where frosts are experienced early pitting results in having the soil fine and crumbly by planting-time.

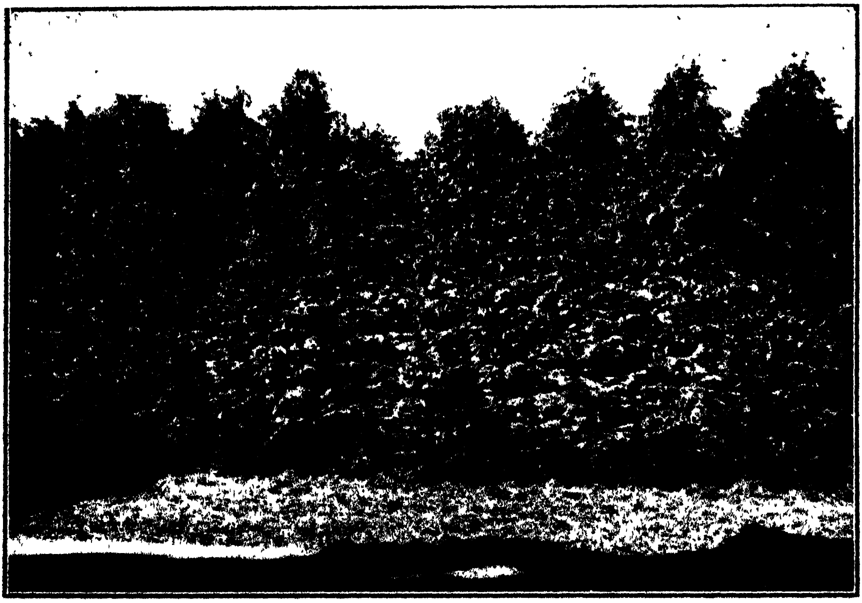

FIG 7. A GOOD ROADSIDE SHELTER OF CUPRESSUS LAWSONIANA..

This shelter has reached the stage when it should have 3 ft. to 4 ft. taken off the top.

Trees should never be planted out into wet, waterlogged soil. Planting in such an area should be delayed until the soil is in a better condition, even if operations are postponed until late in the season.

In planting where open pits have been made, the bottom of each should be firmed and the tree planted in the centre. The fine soil should then be sifted in about the roots and tramped very firmly. The roots must not be bent up or cramped. On a small scale it pays to put a forkful of well-rotted farmyard manure in each pit. If artificial manure is used, blood and bone manure or superphosphate and bone manure in equal parts, allowing two good handfuls a tree, should be applied.

FIG. 8. CUPRESSUS LAWSONIANA USED AS A SHADE TREE IN A PIG-YARD.

PLANTING RULES SUMMARIZED.

(1) A tree should be planted not more deeply than it was planted in the nursery.

(2) Place the tree in the centre of the pit so as to allow even development of the roots. But in very exposed places the plant should be placed against the solid earth on the side of the pit opposite the prevailing wind.

(3) The tree should be planted in an upright position, with tap root going straight down and lateral roots spread out and not bunched together or bent.

(4) Never allow the roots to become dry or even have the appearance of dryness. Carelessness in this direction is probably the most frequent cause of failure.

(5) In the first place work the soil gently in about the roots, then firm it well by tramping.

(6) Do not put grassy sods into the hole. These are liable to cause air spaces and the drying of the roots.

Special care should be taken in planting out eucalypts. A dull day should be chosen, and they should be handled as little as possible. The leaves may wither and fall off after transplanting, but if the plants are strong and properly planted they usually produce new leaves within a few weeks.

MAINTENANCE.

In the first few years of the life of the plantation set out on rough land it pays to clear round each tree a patch the size of the original pit and to replace any failures. Trees that have not been well firmed may be seen to have "worked" at ground-level through swaying, and such trees should be properly firmed. When the trees are from six years to seven years old, some thinning is usually required. Trees that have become crooked, badly balanced, or that have developed double leaders should be cut out, as also should any that are being dwarfed by their neighbours. On workable areas of plantation and alongside hedgerows it pays to keep the land cultivated with a horse hoe for a season or so.

Protection of the plantation against fire can be effected by keeping firebreaks ploughed or disked on ploughable land, and by keeping scrub and rubbish cut and burned on rough country.

METHOD FOR JUDGING PORK AND BACON CARCASSES.

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THE initial development of the export trade of frozen porkers and baconers from New Zealand and Australia was comparatively slow up to 1932, but when it was found that high-quality bacon could be made from suitable frozen carcasses this gave the necessary stimulus to increased production. Development at first was haphazard, and little attention was paid to the vital necessity for selection of the most suitable breeds and strains to give the type of carcass demanded by the consumer. The organization of the New Zealand Pig Marketing Association and the development of the Waikato and Manawatu-Oroua Pig Recording Societies, which were financially assisted by the New Zealand Meat Producers Board, provided the machinery necessary for the organizing of breed and feed trials out of which emerged the material selected for examination in England.

The writers were asked from 1931 onwards to report on the suitability of overseas pig carcasses for the British pork and bacon markets. It became clear that, though there were different ways of submitting the data, it would become increasingly necessary to join forces in investigating the methods so as to present observations and measurements in an agreed and standardized form, such as is now put forward.

Although the scheme described below has been worked out on frozen carcasses, considerable use has been made of the data which have emerged from efforts to supply a similar method of judging in the case of bacon and pork carcasses exhibited at the London Dairy Show and the National Pig Breeders Association's carcass competition at Peterborough. In our view there is no reason why the method should not be applied, modified as to marks for softness of fat and quality and texture of flesh, to fresh carcasses.

During the last five years we have accordingly been engaged not only in devising the best possible proportion of marks from different observations, but in investigating optimum measurements for the different weight classes of frozen pig carcasses. The New Zealand Department of Scientific and Industrial Research initiated regular shipments of recorded pigs, and during the last five years we have examined a large number of carcasses of various weights, breeds, and crosses of pigs, all carefully recorded as to breed and feed. This valuable material, together with competition carcasses from New Zealand and Australian Agricultural Shows, has enabled us to focus attention on the desirable and undesirable characteristics of the individual pigs and at the same time to evolve the scheme herein described which was designed to define and measure quality.

Since the experiments in judging and describing the carcasses were first started we have tried many different methods. Throughout our object has been to build up a system which could be carried out by any one (not necessarily an expert) and at any time, with a reasonable certainty that the results would be on the same standard in every case. For this reason we have, whenever possible, tried to obtain a *measurement* to express the point rather than to rely on visual judgment, into which the personal element enters. As regards three points, however (hams, shoulders, and streaks), we have not yet been able to arrive at a satisfactory measurement. For the streak several methods have been tried and discarded as imperfect; further work on these points is required before judgment by measurement is applied. Therefore, for the judgment of hams, shoulders, and streaks by the visual method we have constructed photographic standards covering the allotted range of marks, so that the personal element can be reduced to a minimum.

In view of the present considerable variation in the methods of judging at carcass competitions we consider that a stage has now been reached when the publication of the method will prove useful both for competitions and for those supplying the British market. We hope that it will prove useful in helping to standardize judging, and, while we do not suggest that it is yet perfect, its publication may give a chance to others to make improvements.

DESCRIPTION OF METHOD.

General.—In many cases our terms of reference have been to report generally on "the suitability of carcasses for the British market." Whether carcasses will meet the requirements of any given market depends on several different factors, including the carcass weights, appearance, conformation, and texture. In the case of frozen carcasses it is not possible to judge texture, in which softness of fat is an important factor. If it is required to judge this point the best test is the chemical one of "iodine number" of the fat.

Once the requirements of the market regarding carcass weight, quality of butchering, and dressing are known, there remains the important matter of determining whether the breeding and feeding of the pig is giving the conformation required.

We have accordingly devised a scale of points in which 100 marks are awarded for those points which deal with breeding and feeding. Marks for appearance, marketing, and for the suitability of weight classes are given over and above this total.

Marks for suitability of carcass weight have been given by us only for bacon carcasses, in which the matter is more important than in the case of pork.

In carcass competitions it is usual to specify the weight limits within which carcasses must fall. When, however, experiments are being made to test out the effect of breed or feed factors as they affect the quality of the carcass it has sometimes happened that all the pigs in the experiment have been killed on the same day and the carcasses sent for inspection at rather widely divergent weights. It is, however, advisable to kill the pigs as they come to the weight required, say about 100 lb. live-weight for pork and 200 lb. live-weight for bacon, and store the carcasses until the lots are complete. This is much better than killing all at one time whatever their weights, for the proportions of fat, muscle, and bone vary with the weight, and what may be a lean carcass at 50 lb. or 120 lb. may be a fat one at 100 lb. or 180 lb. For experimental purposes the time the pigs take to reach this live-weight can always be used as a measure of the efficiency of the breed or the ration.

The scale of points drawn up for judging the carcasses comprises two sets of marks—(1) Marketing Points, which, for the most part, consist of defects which may occur in the industrialization, dressing, or transport of the carcass, and which affect the price realized by affecting its appearance when exposed for sale; (2) Breeders' Points, which consist of defects caused by the breeding or methods of feeding and management adopted on the farm. These two have been kept separate so that, in cases where one or other only is required, they can be used independently. The Breeders' Points have again been subdivided into (*a*) those which are based on visual judgment (Inspection Points) and (*b*) those which are based on measurement (Measurement Points).

The scale of points and marks adopted for both pork and bacon is as follows:—

Table I.

	Marks	
	Porkers.	Baconers.
(1) Marketing Points—		
Colour—clean, fresh, white	5	5
Skin—smooth and fine	5	
Dressing—freedom from bruises and hair	5	5
	15	10
(2) Breeders' Points—		
(*a*) By inspection—		
Hams—well filled and fine-boned	8	8
Shoulders—light	7	7
Streak—thick, full of lean meat	12	12
(*b*) By measurement—		
" Eye muscle " of loin—thick	28	28
Back fat thickness—correct proportion	20	20
Body length—in proportion to weight	20	20
Leg length—short	5	5
	100	100
(3) Suitability of carcass weight	..	15
Total marks	115	125

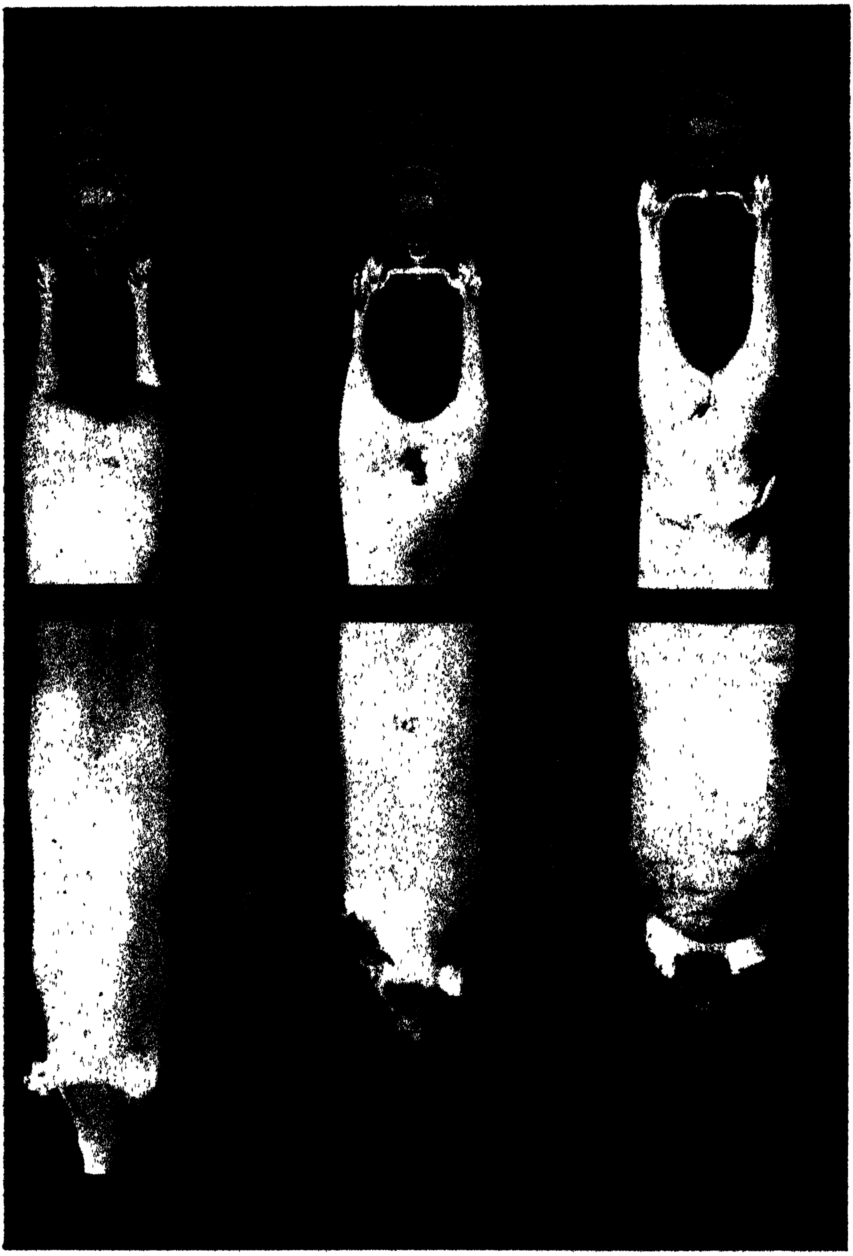

FIG. 1. JUDGING BY EYE-APPRAISAL.

Standards for award of marks.

The relative number of marks given to each point has been carefully considered according to the relative market value of the point. For example, a carcass poor in the " eye muscle," or thickness of lean meat, can drop many more points than one which is thick in the shoulders. The sum total of the points therefore represents the desirability of the carcass from a market point of view. The standard set is a high one, and any carcass which obtains over half marks on any point is a good one in that respect.

JUDGING IN THREE STAGES.

The judging is carried out in three stages :—

(*a*) The carcasses are weighed and are hung up in a row with their backs to the judge. The Marketing Points (colour, skin, and dressing) and the hams and shoulders of the Breeders' Points are then judged.

(*b*) Each carcass is then sawn down the middle line, and the body length and the leg length are measured with a tape-measure graduated in millimetres.

(*c*) One side of each carcass is then sawn straight through at the level of the last rib, and the hinder ends are laid in a row with the cut surfaces facing the judge. On the exposed cut surface the streak is judged, and the " eye muscle " and back fat are measured by fine pointed callipers and read off on a wooden ruler scale in millimetres.

The level of the last rib has been selected to make this cut, for not only does it expose the most valuable part, but also the latest developing part of the carcass A part which grows late during development of the animal forms the best index of the state of the development of the carcass as a whole.

THE SCALE OF POINTS EXPLAINED.

A brief description of the points and the methods used in judging them is as follows :—

MARKETING POINTS.

Colour (5 marks) : The colour shall be a clean fresh white. Points should be deducted for dark coloration due to pigmented skin, sunburn before slaughter, or excessive drying in storage, as well as for the dead white blebs found as faults in cold storage.

Skin (5 marks) : The skin should be smooth and not too thick or coarse.

Dressing (5 marks) : Bruises and weals due to fighting before slaughter should be absent. There should be complete absence of all hair and absence of scraper cuts in the skin. The method of allowing the forelegs to hang naturally is preferable to hooking them back, as the latter makes the shoulders appear heavier than they are.

BREEDERS' POINTS.

(*a*) *By Inspection.*—For these photographic scales are used (see Figs. 1 and 2).

Hams (8 marks) : The bone should be fine and the ham well filled out with lean meat, the space between the legs being U-rather than V-shaped. The hams to be judged are compared with the photographic scale of hams (Fig. 1) which shows the shape for maximum (8), minimum (1), and intermediate (4) marks, to be awarded.

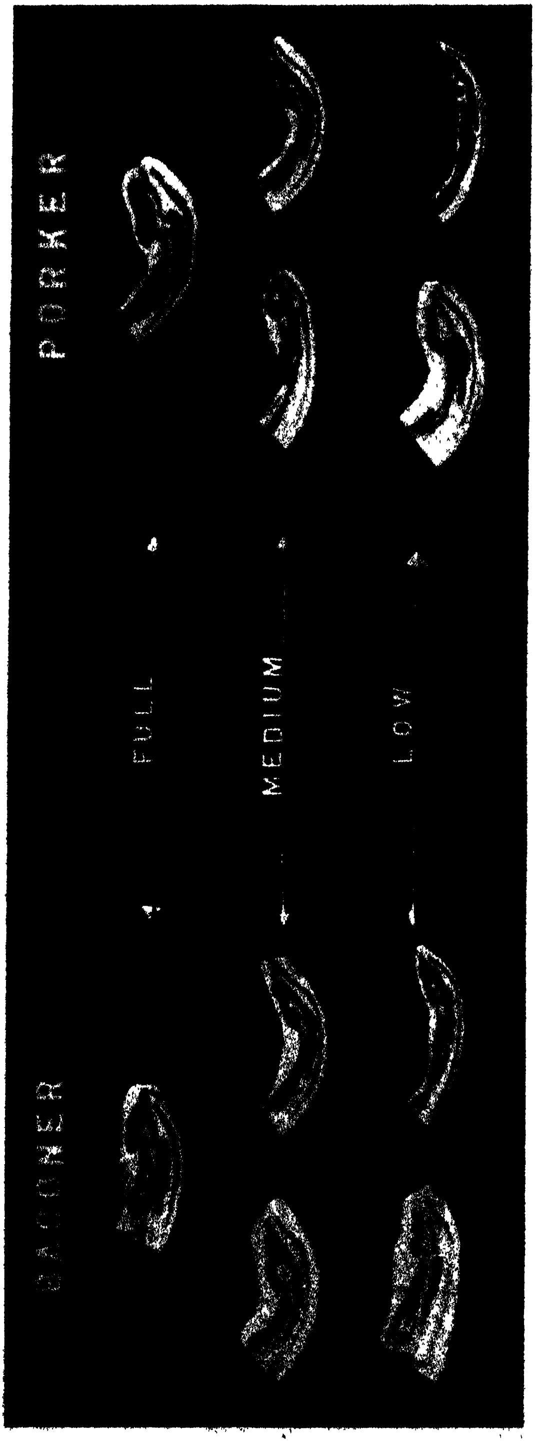

FIG. 2. JUDGING STREAKS BY EYE-APPRAISAL.
Standard for award or marks.

Shoulders (7 marks): These should be light in proportion to the rest of the carcass, for it is a low-priced part. In judging, the shoulders are matched against a photographic scale of the shoulders (Fig. 1) which shows the shape for maximum (7), minimum (1), and intermediate (4) marks, to be awarded.

Streak (12 marks): Not only should the belly be thick, but it should contain a high proportion of lean meat. Comparison with the photographic scale (Fig. 2) is made. The maximum marks (12) are given for a streak which is *both* thick and full of lean meat. The minimum marks (1) are given *either* for one which is thin, *or* for one which is thick but which contains a higher proportion of fat. Illustrations of intermediate marks (6) in each case are also shown.

(*b*) *By Measurement.*—Measurement in millimetres rather than in inches (25 millimetres = 1 inch) has been adopted for the sake of greater accuracy and the avoidance of fractions. Since the actual measurement will vary with the weight of the carcass, Tables II to V have been drawn up for different weight groups. From these tables the marks corresponding to any particular measurement can be read off. In the case of thickness of "eye muscle" and length of body, the highest marks are given for the maximum measurement, and in the case of the length of leg for the minimum measurement. For thickness of fat, on the other hand, as for suitability of carcass weight, the highest marks are awarded for an optimum measurement.

"Eye Muscle" of Loin (28 marks): The thickness is measured halfway along its width (see Fig. 3). This gives the best measure of the thickness of lean meat throughout the carcass. Different carcasses vary much more in the thickness than in the width of the muscle, so the thickness has been selected as the index of lean meat. The scale for converting measurements to marks is given in Table II.

Back Fat Thickness (20 marks): This is measured 1 in. for porkers and 1½ in. for baconers from the middle line, with one point of the callipers at the edge of the "eye muscle" and the other just on the inner layer of the skin (see Fig. 3). This gives a better measure of the amount of fat in the carcass than does the measurement of the fat at the shoulder, for it is the last part of the back fat to develop. Fat differs from all other points for marking, inasmuch as for each weight group of carcass there is an optimum requirement of back fat: there can be too little as well as too much. Consequently the scale for converting measurements to marks (Table III), unlike the others, is extended on both sides of the optimum. In the case of pork, if the carcass is too fat the rind and the fat down to the required thickness has to be removed. It is therefore more profitable to supply this small pork, for which there is a growing demand in industrial areas, with the right amount of fat, so that it can be sold direct to the consumer with the rind on. At one time we considered the measurement of the thickness of the back fat from the point of the "eye muscle" farthest from the backbone to the skin (as shown in Fig. 3), as it is here that the thickness of the fat shows up in the cut. Agreement was good when all measurements were taken by one person, but not when they were taken by different persons, for it is more difficult to judge the exact point

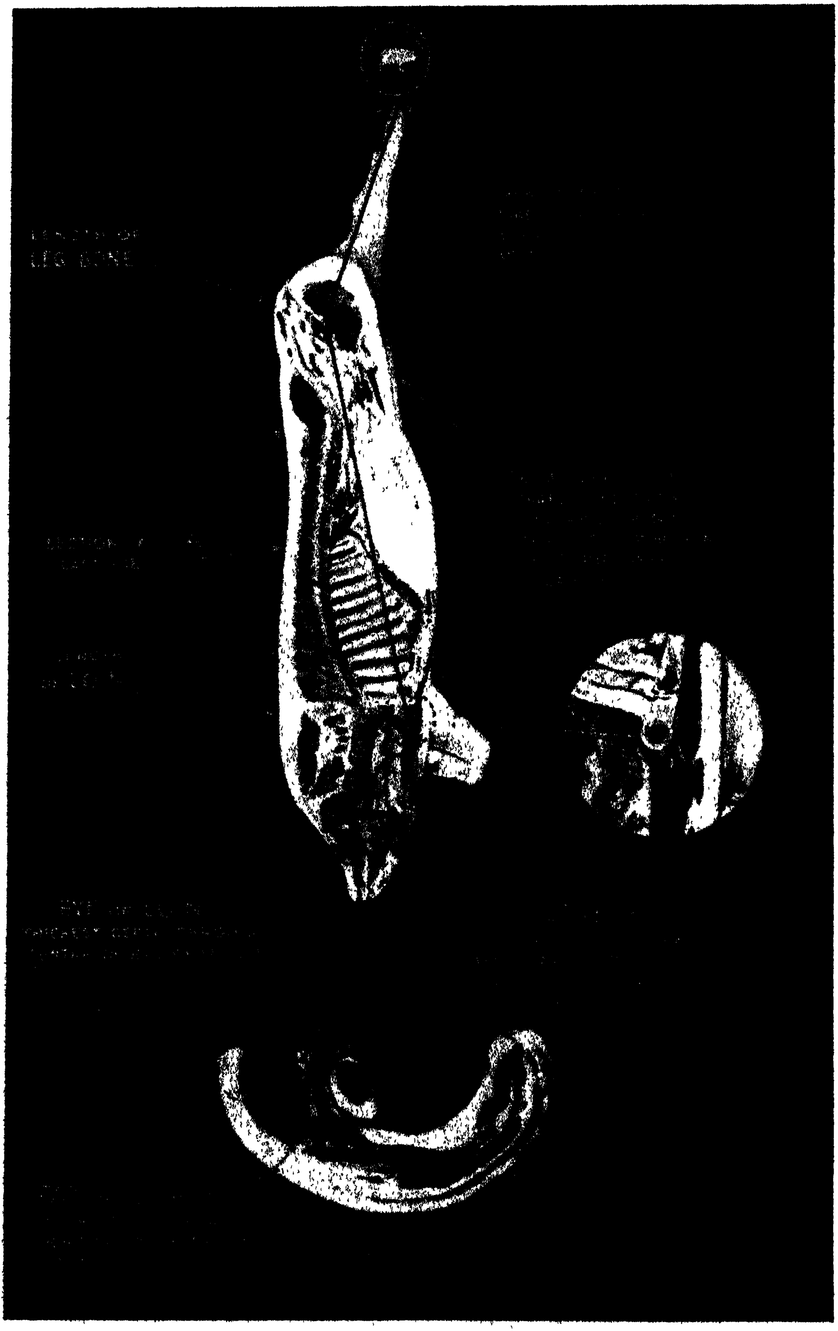

FIG. 3. JUDGING BY AWARD OF MARKS FROM MEASUREMENT.
Measurement with callipers read off on a ruler scale marked in millimetres.

at which the measurement should be taken here than in the place which we have adopted. Fig. 3 shows the discarded method of measurement of back-fat thickness.

Table II. Marks for Thickness of "Eye Muscle" of Loin

(Measurements in millimetres.)

Carcass Weight, Pounds.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	85 to 89.	90 to 99	100 to 109.	110 to 119.	120 to 139.	140 to 159.	160 to 179.	180 to 199.
Marks													
1	23	24	25	26	27	28	29	30	31	32	33	34	35
3 .. .	24	25	26	27	28	29	30	31	32	33	34	35	36
5	25	26	27	28	29	30	31	32	33	34	35	36	37
7 ..	26	27	28	29	30	31	32	33	34	35	36	37	38
9 . .	27	28	29	30	31	32	33	34	35	36	37	38	39
11	28	29	30	31	32	33	34	35	36	37	38	39	40
13 . .	29	30	31	32	33	34	35	36	37	38	39	40	41
14 . .	30	31	32	33	34	35	36	37	38	39	40	41	42
15 .	31	32	33	34	35	36	37	38	39	40	41	42	43
16 .. .	32	33	34	35	36	37	38	39	40	41	42	43	44
17 . ..	33	34	35	36	37	38	39	40	41	42	43	44	45
18	34	35	36	37	38	39	40	41	42	43	44	45	46
19	35	36	37	38	39	40	41	42	43	44	45	46	47
20 . ..	36	37	38	39	40	41	42	43	44	45	46	47	48
21 . ..	37	38	39	40	41	42	43	44	45	46	47	48	49
22 .. .	38	39	40	41	42	43	44	45	46	47	48	49	50
23 .. .	39	40	41	42	43	44	45	46	47	48	49	50	51
24 .	40	41	42	43	44	45	46	47	48	49	50	51	52
25 .. .	41	42	43	44	45	46	47	48	49	50	51	52	53
26	42	43	44	45	46	47	48	49	50	51	52	53	54
27 .. .	43	44	45	46	47	48	49	50	51	52	53	54	55
28	44	45	46	47	48	49	50	51	52	53	54	55	56

Table III.—Marks for Thickness of Fat over Loin

(Measurements in millimetres.)

Carcass Weight, Pounds.	60 to 69.	70 to 79	80 to 89.	90 to 99.	100 to 109	110 to 119.	120 to 129.	130 to 139	140 to 149.	150 to 159	160 to 169	170 to 179.	180 to 189.	190 to 199
Marks														
1 ..	1	1	2	3	4	5	7	8	9	10	11	12	13	14
4 ..	..	2	3	4	5	6	8	9	10	11	12	13	14	15
7 ..	2	3	4	5	6	7	9	10	11	12	13	14	15	16
10 ..	3	4	5	6	7	8	10	11	12	13	14	15	16	17
12 ..	4	5	6	7	8	9	11	12	13	14	15	16	17	18
14 ..	5	6	7	8	9	10	12	13	14	15	16	17	18	19
15 ..	..	..	..	..	.	..	..	14	15	16	17	18	19	20
16 ..	6	7	8	9	10	11	13	15	16	17	18	19	20	21
17 ..	..	..	.	..	..	..	14	16	17	18	19	20	21	22
18 ..	7	8	9	10	11	12	15	17	18	19	20	21	22	23
19 ..	8	9	10	11	12	13	16	18	19	20	21	22	23	24
20 ..	9	10	11	12	13	14	17	19	20	21	22	23	24	25
19 ..	10	11	12	13	14	15	18	20	21	22	23	24	25	26
18 ..	11	12	13	14	15	16	19	21	22	23	24	25	26	27
17 ..	..	..	..	..	..	..	20	22	23	24	25	26	27	28
16 ..	12	13	14	15	16	17	21	23	24	25	26	27	28	29
14 ..	13	14	15	16	17	18	22	24	25	26	27	28	29	30
12 ..	14	15	16	17	18	19	23	25	26	27	28	29	30	31
10 ..	15	16	17	18	19	20	24	26	27	28	29	30	31	32
7 ..	16	17	18	19	20	21	25	27	28	29	30	31	32	33
4 ..	17	18	19	20	21	22	26	28	29	30	31	32	33	34
1 ..	18	19	20	21	22	23	27	29	30	31	32	33	34	35

Table IV.—Marks for Body Length (Symphysis Pubis to First Rib).

(Measurements in millimetres.)

Carcass Weight in Pounds.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	85 to 89.	90 to 94.	95 to 99.	100 to 104.	105 to 109.	110 to 114.	115 to 119.	120 to 124.	125 to 129.	130 to 134.	135 to 139.	140 to 144.	145 to 149.	150 to 154.	155 to 159.	160 to 164.	165 to 169.	170 to 174.	175 to 179.	180 to 184.	185 to 189.	190 to 194.	195 to 199.
Marks																												
1	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820
2	555	565	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825
3	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830
4	565	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835
5	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840
6	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845
7	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850
8	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855
9	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860
10	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865
11	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870
12	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875
13	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880
14	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885
15	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890
16	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895
17	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900
18	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895	905
19	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910
20	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895	905	915

Table V.—Marks for Leg Length (Symphysis Pubis to Toe).

(Measurements in millimetres.)

Carcass Weight in Pounds.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	85 to 89.	90 to 94.	95 to 99.	100 to 104.	105 to 109.	110 to 114.	115 to 119.	120 to 124.	125 to 129.	130 to 134.	135 to 139	140 to 144.	145 to 149.	150 to 154.	155 to 159.	160 to 164.	165 to 169.	170 to 174.	175 to 179.	180 to 184.	185 to 189.	190 to 194.	195 to 199.
Marks																												
		and	over																									
1	450	460	470	480	490	500	510	520	530	540	550	560	570	575	580	585	590	595	600	605	610	615	620	625	630	635	640	645
2	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	559 to 550	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615	629 to 620	634 to 625	639 to 630	644 to 635
3	439 to 430	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	559 to 550	564 to 555	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615	629 to 620	634 to 625
4	429 to 420	439 to 430	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	554 to 545	559 to 550	564 to 555	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615
5	419	429	439	449	459	469	479	489	499	509	519	529	539	544	549	554	559	564	569	574	579	584	589	594	599	604	609	614
		and	under																									

Body Length (20 marks): This is measured with a tape measure from the edge of the symphysis pubis bone to the junction of the sternum with the first rib (see Fig. 3). It gives a measure of the length of the valuable loin joint which can be cut off the carcass. A high proportion of this to the weight of the carcass as a whole increases the value of the carcass for cutting purposes. The scale for converting measurements into marks is given in Table IV.

Leg Length (5 marks): This is measured with a tape measure in a straight line from the edge of the symphysis pubis bone to the tip of the toe (see Fig. 3). When taken in relation to the weight of the carcass it gives a measure of the amount of bone in the carcass. The scale for converting measurements to marks is given in Table V.

PORK.

The weights of carcasses most in demand for the London Trade are from 60 lb. to 80 lb., although during the summer months and in some other markets there is some demand for rather heavier carcasses for cutting purposes. The latter conveniently fall into two main groups—80 lb. to 100 lb., and 100 lb. to 120 lb. Since the main trend of future trade, on analogy with " Canterbury Lamb," will probably lie with the 60 lb. to 80 lb. group, it is on this group that we have concentrated most. Scales have, however, been prepared for the other groups as well.

(The bacon scheme now operating in Great Britain has caused a considerable amount of variation in the demand for these various porker weights quite out of proportion to the normal, as indicated above.)

Since there was comparatively little detailed published information available to us relating to the most suitable types demanded by the consumer, we were compelled to construct for the first time measurement and inspection standards which we believe accurately reflect consumer preferences.

The scale of marks is the same as for bacon. The standard, however, is in one respect different. In the case of pork, it is important that not only should the belly be thick but that it should contain a higher proportion of lean meat. Comparison with the photographic scale (Fig. 2) is made. As already stated the maximum marks (12) are given for a streak which is *both* thick and full of lean meat. The minimum marks (1) are given *either* for one which is thin, *or* for one which is thick, but which contains a high proportion of fat. Illustrations of intermediate marks (6) in each case are also shown. In the case of the back fat thickness, too, one slight alteration has to be recorded. For pork this measurement is taken 1 in. from the middle line, as compared with 1½ in. on bacon carcasses.

BACONERS.

In considering bacon we have taken as our standard a Class I carcass for the Wiltshire trade under the British Bacon Scheme just as we have taken the small 60 lb. to 80 lb. London porker as the ideal standard for pork.

The weights of the carcasses suitable for making bacon will vary slightly with the type of pig used. For Wiltshire sides, made from breeds such as the Large White, the optimum carcass weight is 150 lb., but where, as in most of the material we are dealing with, the breed (Berkshire crosses) is of early-maturing type, as used for the production of small porkers, a rather lower weight is advisable on account of the tendency of the pig to remain rather short and put on fat at weights above 150 lb. For districts which are beginning for the first time to produce frozen bacon-pig carcasses for this country we have therefore added to our scale of points one for "Suitability of Carcass Weight" (Table VI). To give the optimum carcass weight of 135 lb to 154 lb. for this type of pig a live-weight of from 180 lb. to 200 lb is required.

It will be noticed that carcasses falling much under the optimum weights are penalized more than those which are over these weights, for they are less suitable for making into bacon.

Streak (12 marks): For bacon purposes rather more fat is allowable than for pork, and so a different photographic scale is used (see Fig 2).

Back Fat Thickness (20 marks): This measurement is taken 1½ in. from the middle line. Since the actual thickness of the fat is much greater in a heavy bacon carcass than in a light pork carcass, the latitude (in millimetres) that can be allowed for a reasonably good carcass is larger. In Table III, which gives the scale for converting measurements to marks, therefore, the drop in marks for each millimetre from the optimum measurement is less than for pork carcasses.

Table VI Bacon Pigs Marks for Suitability of Carcass Weight

Marks	Carcass Weight Pounds
1	110–114
4	115–119
7	120–124
10	125–129
13	130–134
15	135–154
14	155–159
13	160–164
12	165–169
11	170–174
9	175–179
7	180–184
5	185–189
3	190–194
1	195–199

ACKNOWLEDGMENTS

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CHRONIC ZINC-POISONING OF PIGS.

RESULTS OF EXPERIMENTAL FEEDING OF PURE ZINC LACTATE.

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In the *New Zealand Journal of Agriculture* for July, 1936, p. 34 (1), attention was drawn to the possibility that unthriftiness, arthritis, and mortality in young pigs may, in some cases, have been connected with the solution, in the skim-milk upon which the pigs were fed, of large amounts of zinc from the galvanized-iron piping used for conveying the milk to the piggeries.

In view of the negative findings of American investigators on the possibility of the existence of chronic zinc-poisoning, and also doubt as to the parts played by biological factors, and chemical substances other than zinc, in the causation of the disease, it was decided to institute experiments at the Wallaceville Veterinary Laboratory.

THE WALLACEVILLE EXPERIMENTS.

To ensure that conditions should approximate as nearly as possible to those obtaining on the farms where trouble among the pigs had been associated with the use of galvanized-iron pipes, and at the same time obviate possible uncertainties due to insolubility of zinc oxide and complicating effects of impurities such as lead, arsenic, or cadmium, it was decided to feed zinc in the form of lactate, prepared and tested in the laboratory for purity. Ten pounds of B.P. zinc oxide was obtained as a bulk supply, and showed on analysis the following results :—

Lead, Cadmium.—No trace of precipitate or darkening on passing H_2S through a solution of 10 gm. dissolved in just sufficient hydrochloric acid to effect complete solution and diluted to about 100 cc. A trace of lead acetate solution when added to this solution gave a pronounced black precipitate. No precipitate or trace of lead chromate on applying the test prescribed by the U.S.P.

Arsenic.—No trace by Marsh test using 4½ gm.

The zinc oxide was dissolved in lactic acid B.P. (tested for heavy metals with negative result) and the precipitated zinc lactate filtered off, dissolved in hot water, and allowed to crystallize on cooling. The snow-white zinc lactate was then filtered on a buchner funnel and tested for acid-insoluble-sulphide metals with entirely negative results.

ZINC LACTATE FEEDING TO PIGS.

Three young healthy weaners were selected from a litter of ten young pigs. The three were fed in a common trough with whole-milk and a little meal to which the zinc lactate previously dissolved in water was added. The milk contained approximately 0·1 per cent. of zinc as lactate.

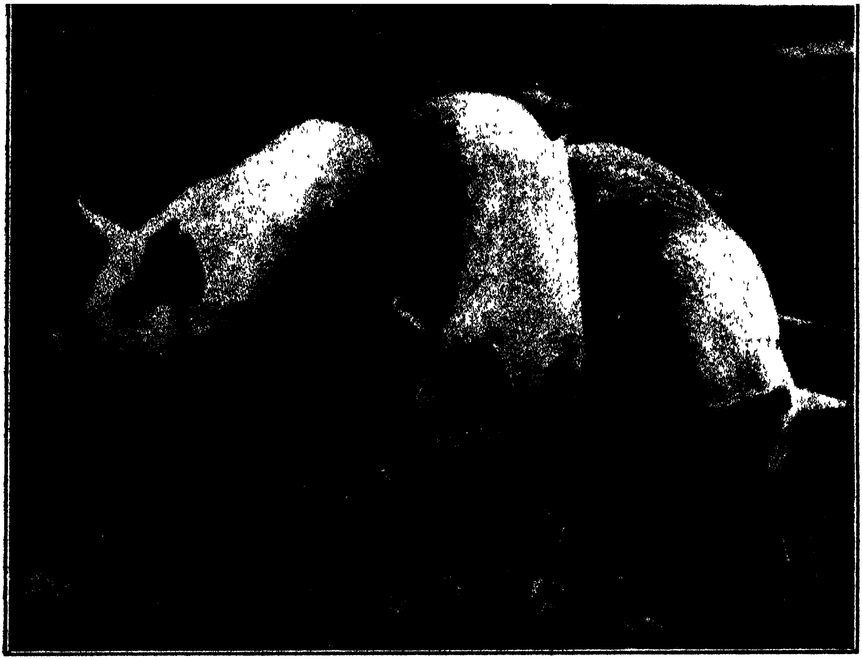

FIG 1. ZINC-FED GROUP.

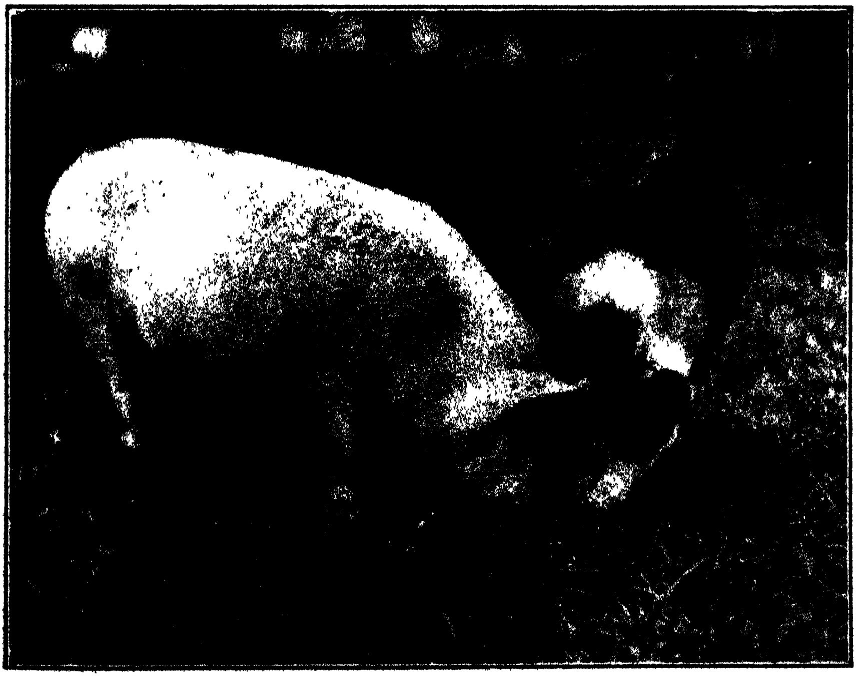

FIG. 2. CONTROL GROUP.

The trial commenced on the 11th August and continued until the last pig was killed on the 4th November. On about the 10th October —two months after the commencement of the feeding experiment— the pigs commenced to leave some of their milk, and the quantity was at once cut down. Just before "going-off" their food the pigs were all noticed to be stiff in action. By the 13th October the pigs were noticeably lame, one much more so than the other two. They also appeared to be rougher in the coat and more flat-sided than their control litter-mates not receiving zinc. On the 23rd October it was decided to kill the pig showing most lameness, while a second pig died on the 24th probably due to the handling of the day before. The third pig, which was killed on the 4th November, was showing similar lameness to that of the others previously killed.

It is estimated that the three pigs received the following amounts of zinc lactate, assuming that each had drunk a similar amount of milk :—

No. 1 pig, which died 23rd October, 1936, 804 gm. zinc lactate = 181 gm. zinc.
No. 2 pig, which died 24th October, 1936, 824 gm. zinc lactate = 185 gm. zinc.
No. 3 pig, which died 4th November, 1936, 1,055 gm. zinc lactate = 237 gm. zinc.

POST-MORTEM EXAMINATION OF PIGS.

No. 1.—This was definitely the worst case, but no scouring had been observed. The blood had a thin watery appearance, but clotted exceedingly quickly. Heart, lungs, and pancreas appeared normal. There was no congestion of the alimentary tract and no evidence of scouring. The liver showed an obvious central necrosis of lobules, and was of a pale-brown colour. The kidney was rather too brown in the cortex, and urine was tinged with bile.

The chief changes, however, were noticeable in the ends of the humerus. The head of the humerus in both legs showed a collapse of the bony structure beneath the overlying cartilage. In one case there was erosion of the cartilage as well, and a definite lifting of that cartilage from the bone beneath. The ends of the bones were weak and cancellous and suggestive of serious mineral deficiency. The synovial fluid was slightly blood-stained, and gave a growth of Streptococci and Staphylococci. No noticeable changes were to be seen at the ends of other long bones.

Pig No. 2.—Found dead 24th October. Had been noticeably lame on the left foreleg but had not scoured. The heart, lungs, pancreas, liver, and bladder appeared normal. The kidney was pale and contained a gelatinous fluid in the pelvis. There was slight catarrh and congestion of the mucosa of the stomach, otherwise the alimentary canal appeared normal. Brain appeared congested.

The long bones were examined, and the only one noticeably bad was the head of the left humerus, which was similar to that of No. 1. The joint fluid gave no growth of organisms on culture.

Pig No. 3.—Post-mortem examination was made on 4th November, 1936. This was the largest of the three pigs, but was very lame in the front legs. There had been no scouring, but the pig appeared unthrifty. All organs appeared normal, and no changes were observed in the alimentary canal.

Analysis of blood for calcium and P_2O_5 gave normal results, and blood histology showed no changes. Examination of the long bones revealed changes in the humerus in both forelegs and at the proximal and distal ends. The cartilage of the head of the humerus had lifted, and in places showed definite erosion, while the bone was spongy. There was some erosion, and considerable fluid was present in the humero-radial joints. No organisms were recovered from the synovial fluid on culture. There was also in this pig a similar lesion on the head of a femur.

MICROSCOPICAL EXAMINATION OF ORGANS.

Liver. -In pig No. 1 a wide zone of cellular necrosis appeared round the central vein of the lobule, but in pigs Nos. 2 and 3 no changes could be observed.

Pancreas.—In all three cases the pancreas was considered normal. The suggestion that a fibrous condition existed could not be confirmed when one considered the fibrous condition of the organs of normal pigs.

Kidney.—No. 1 pig showed definite glomerulo-nephritis, but the other two pigs showed only comparatively slight changes.

Eosinophilic droplets were found to be present in the glomerular sacs in numbers, and passing through to the convoluted tubules. Lining-cells of the convoluted tubules appeared to be secreting excessively, so that long processes of the cells jutted out into the lumen and appeared to deposit irregular droplets which took the haematoxylin stain. In parts there had been an accumulation of debris forming blockages of the tubules. Where such casts had formed, erosion of the cells had taken place, and occasionally the basement membrane had ruptured. A cystic condition of a few of the tubules had resulted.

SUMMARY.

Zinc lactate feeding of pigs resulted in lameness and unthriftiness.

Damage occurred in one case in the liver and to some extent in kidneys of experimental pigs.

The humerus was badly damaged in each case, the cartilage having lifted off a soft spongy underlying bone. This non-specific arthritis was the cause of the lameness, and was produced apparently by an upset of mineral metabolism resulting from prolonged zinc feeding.

ANALYTICAL RESULTS ON BIOLOGICAL MATERIAL FROM WALLACEVILLE PIG-FEEDING EXPERIMENTS.

A representative series of samples was collected from each pig as soon as it was dead, with special precautions to avoid contamination with zinc. The samples were immediately weighed and the analysis commenced on the fresh material. Unfortunately the control littermate pigs were not available for killing at the time, so that to secure a basis for comparison the blood and organs of an ordinary pig killed at the abattoirs were secured and analysed.

Data on the zinc content of pig-organs was lacking in the available literature, but comparison could be made with the figures for other mammals, including man, cattle, dog, cat, horse, rabbit, and rat. The results of analysis of the pig-organs are given in the accompanying table :—

Table showing Zinc-content Determinations in Wallaceville Pig Experiments.

——	Pig No. 1.	Pig No. 2.	Pig No. 3.	Normal Pig. J/943.
Mg. in 1 kg. of wet weight—				
Blood	12·0* (22nd Sept.)	6·5 (22nd Sept)	8·1 (22nd Sept.)	4·49
	8·3 (23rd Oct.)	20·5 (24th Oct.)	12·3 (23rd Oct.)	4·9
			13·3 (4th Nov.)	..
Heart	6·8	9·4	6·7	..
Spleen	23·5	113·6	24·6	19·5
Brain	12·0	14·3	12·9	..
Lung	12·7	14·2	..	..
Pancreas	190·0	610·0	187·8	51·0
Bile	51·5	..	55·9	6·0
Joint fluid	11·0	..	18·0*	..
Ovaries	19·3	..	..	..
Muscle	32·0	29·0	29·0	..
Kidney	1,000·0	1,570·0†	610·0	27·0
Liver	1,020·0	730·0	1,140·0	155·0
Mg. in 100 cc. urine ..	0·17 (26th Sept.)	0·9 (26th Sept.)	0·55 (26th Sept)	0·15
	0·35 (20th Oct.)	0·45 (20th Oct.)	0·27 (19th Oct.)	..
	0·6 (23rd Oct)	2·17 (24th Oct)	0·27 (20th Oct.)	..
			0·33 (4th Nov.)	..
Mg. in 1 kg. of ash—				
Bones	..	..	..	..
Humerus (lower end) ..	2,276	1,844	1,102	251
Femur (lower end) ..	1,202	1,330	906	..
Humerus (shank) ..	597	828	623	193
Femur (shank) ..	260	720	486	..

* Doubtful; amount of material available insufficient for accurate determination. † Exact figure somewhat doubtful; material all used.

NOTES ON THE TOXICITY OF ZINC.

The toxicology of zinc may be considered under three headings :—

(1) Acute poisoning due to the caustic or corrosive action of certain soluble zinc salts, especially the chloride and sulphate, on the alimentary canal. This local action is well authenticated, and is not due to a general or systemic toxic effect of the metal or metallic ion.

(2) Brass founders' ague or metal fume sickness is an acute febrile condition resulting from the breathing of very finely dispersed particles of metal or oxide in the form of fume. Though generally associated with zinc it has been produced experimentally with other metal fumes, and is believed to be due to the local action of metallic particles of colloidal dimensions on the lung tissues causing denaturation of protein, which is absorbed, giving rise to a kind of anaphylactic shock.

(3) Chronic or occupational zinc poisoning.

On this aspect there has always been the greatest degree of controversy. Most of the experimental work has been carried out with zinc oxide. The majority of investigators assume that zinc oxide is converted to zinc chloride, lactate, or albuminate in the stomach or other parts of the alimentary canal, but several, such as Heller, consider that it is mostly passed through the intestine unchanged.

The toxic effects obtained by certain investigators who have fed zinc oxide is attributed by later workers to impurities, especially lead, arsenic, and cadmium. Others have fed considerable quantities without appreciable effect. Occupational disease is also generally assumed, and, in some cases, proved to be due to these impurities, particularly lead. Dr. H. Engel(2) (Berlin) reviews this aspect in the publication on "Occupation and Health, No. 353," published by the International Labour Office (1931). He considers that pure zinc has a toxicity, if any, similar to copper, and states that zinc ought not to be considered as an industrial poison exerting a general effect due to its absorption. On the other hand, he notes that Kunkel found 28 mg. per kilogram of zinc albuminate given by the alimentary canal to be fatal to the rabbit, and that J. Macht in 1931, by giving 0·5 gm. zinc oxide per kilogram to dogs and cats, caused repeated vomiting, wasting, and shivering, while on the rabbit 1 gm. of zinc oxide was fatal, and 20 mg. caused renal changes. In 1925 Mallory and Parker caused acute glomerulonephritis by injecting 0·5–1 gm. of powdered zinc (metal) under the skin. Kolbert found that non-caustic zinc salts on injection cause paralysis of the central nervous system and vascular system and muscles.

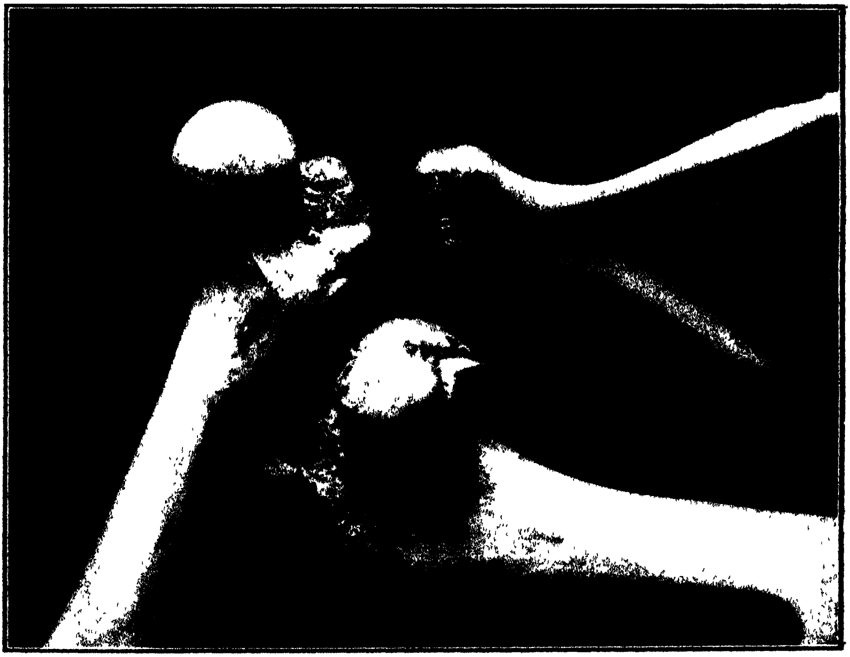

FIG. 3. BONE LESIONS, ZINC-FED PIG.

Batchelor, Fehnel, Thomson, and Drinker(3) carried out a comprehensive clinical and laboratory study of the health of workmen in a zinc-smelting works at Palmerton, Pennsylvania. The New Jersey ore used in this works was very low in lead, cadmium, and arsenic. It was found that fifty-one zinc smelters in perfect health excreted each up to 3·9 mg. of zinc per 100 cc. in the urine and up to 133 mg. in the total fæces daily. The amount involved was thus not of an excessively high order, although continuing over a long time. There were no pathological findings.

Drinker, Thompson, and Marsh(4) in 1926 fed cats and dogs with daily doses of zinc oxide of 0·175 gm. to 1 gm. for periods of from three to fifty-three weeks. All three cats on the highest dose (1 gm.) exhibited at autopsy gross hardening and nodular development of the pancreas, which was overgrown with fibrous tissue partially eliminating the islets. The authors did not attach any significance to these findings, as they considered this dosage greatly in excess of any likely to occur in practice. The animals on all other dosages remained healthy, and showed no damage to any organs on autopsy. The evidence submitted does not indicate that more than a very small fraction of the zinc oxide fed was assimilated.

Similarly, Heller and Burke(5) fed rats with amounts of zinc salts of 0·25 per cent. and 0·5 per cent. of zinc in the diet. It is stated that no toxic effect was observed over several generations. The figures appear to indicate, however, a higher mortality of young in the group on the higher zinc ration. The analytical results showed that no increase of zinc in the organs had taken place, and no evidence was presented indicating that absorption of zinc had taken place from the zinc oxide in the alimentary canal.

DISCUSSION.

The results of the present experiment are clearly at variance with those performed elsewhere, and on which the opinion has been expressed that zinc, apart from the local caustic action of certain zinc salts, is a non-toxic metal, or has a toxicity of an extremely low order. To account for the differing results the following points may be considered :—

(1) In the majority of experiments where zinc has been fed to animals over long periods the zinc has been in the form of the oxide. There is no evidence that other than a small fraction of this insoluble compound when fed to animals is rendered soluble by the digestive juices and absorbed. In the few cases where the soluble mineral salts have been fed, it is possible that their local action on the absorbing surfaces of the alimentary canal has tended to hinder absorption and to promote expulsion.

(2) The pig may be an animal peculiarly susceptible to zinc poisoning. It is well known that animals vary in their reaction to various poisons.

(3) The amounts of zinc fed have been comparatively large, although within the range of possibility for animals under farm conditions, as demonstrated by numerous analyses of milk which have been collected from installations where lengthy galvanized-iron pipes are used.

(4) The effects—at least so far as the bone lesions are concerned—may be principally due as suggested to an upset of mineral metabolism.

Further experiments are in progress using half and quarter the amount of zinc to determine at what level demonstrable effects appear in the pigs. A recent report indicates that no further trouble has been experienced on the farm at Atiamuri, where the first case occurred, subsequent to the removal of the zinc from the pipes, although conditions are otherwise unaltered.

ACKNOWLEDGMENT.

The authors wish to thank Mr. D. H. Le Souef, Veterinarian, Wellington, for assistance in obtaining normal pig-organs. The illustrations are from photographs taken by Mr. A. L. Bryant.

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CARCASS-QUALITY IN BACON PIGS.

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PART II.—THE INFLUENCE OF SUPPLEMENTARY CONCENTRATES ON CARCASS-QUALITY.

BOTH in New Zealand and in the United Kingdom critics of the New Zealand methods of raising and fattening pigs practically exclusively on dairy by-products—separated milk, buttermilk, and whey—have frequently expressed the opinion that this method of feeding injuriously affects the quality of the bacon produced from such pigs. Their opinion is undoubtedly influenced by practices that prevail in European countries, and that are not necessarily applicable under New Zealand conditions. In particular, it has been suggested that the feeding of large volumes of separated milk causes thin bellies, and gives rise to the condition described by the trade as "paper flanks."

Accordingly a series of experiments was designed to investigate thoroughly these assertions by comparing the quality of carcasses of pigs fattened exclusively on factory buttermilk with those of others fattened on varying quantities of concentrate meals in addition to buttermilk.

EXPERIMENTAL TECHNIQUE.

Three series of group-feeding trials involving 106 Tamworth-Berkshire cross pigs were conducted over a period of three years. Detailed description of the technique, feeding, and economy aspects of these trials have already been reported in this journal(9).

Briefly, the appetite of the pigs governed the quantity of buttermilk fed to all groups. With the supplemented groups a grain-meal mixture was fed on a per 100 lb. live-weight per day basis, the actual quantity varying between the different groups. Thus in Series A and B the control group received buttermilk only, and the respective supplemented groups an addition to the daily ration of from ¾ lb. to 2 lb. of meal per 100 lb. live-weight. In each case in these series, supplementing extended over the whole fattening-period. (Table VII.)

On the other hand, Series C was designed to fill in the experimental gaps in A and B by studying in particular the stage of growth at which —if at all—it is beneficial from both the quality and economy viewpoints to supplement buttermilk with concentrate feeds. Accordingly, meal was fed with buttermilk at varying rates and over different growth stages during the fattening-period, which extended from weaning to bacon weights. Thus meal was fed during the early stages from weaning to pork weights, during the late stages from pork to bacon weights, throughout the whole fattening-period, and at a heavier rate during the early stage than during the late. The pigs received buttermilk only during the non-supplemented stages. (See Table VII and Reference 9.)

All pigs were slaughtered as they reached 200 lb. live-weight, and were handled at and after slaughter as described in Part I of this paper, being shipped to London for examination after examination as carcasses at the New Zealand end. For special reasons a few carcasses were not exported, but the data relating to these was recorded in New Zealand.

The results reported are based largely upon the measurements taken by and the opinions of the New Zealand Pig Carcass Evaluation Committee, and the author takes this opportunity of thanking Messrs. H. R. Davidson, John Hammond, J. B. Swain, and N. L. Wright for their careful and detailed work.

INFLUENCE OF DIET ON THICKNESS AND QUALITY OF STREAK AND THICKNESS OF BELLIES.

Data based upon actual measurements only are reported, partly for reasons of space and partly because effects were noticeable only in respect to "internal" quality characters.

A convenient summary of the group results is obtained by examining the average value obtained for each character, expressed on a percentage basis, the standard of comparison being that of the Committee(1).

The general picture presented by these results (Table VII) clearly indicates that the addition of concentrate supplements to the buttermilk ration produced no measureable improvement in the bellies of bacon pigs. Within Series A and B, where the quality of the streak was assessed by measurement on the loin-cut (at last rib) the respective groups are equally efficient. In Series C where evaluation was made by comparison with standard photographs, the efficiency differences existing are in favour of the groups receiving little or no meal.

Table VII.—Summary of Carcass-quality Results

(Percentage Efficiency.)

—	Series A.			Series B			Series C.				
	Group 1.	Group 2.	Group 3.	Group 1.	Group 2	Group 3	Group 1	Group 2.	Group 3.	Group 4.	Group 5.
Rate of meal-supplementing per 100 lb. live-weight per day	Nil whole period	1 lb whole period	2 lb whole period	Nil whole period	¾ lb whole period	1½ lb whole period	Nil whole period	1 lb whole period(1)	1 lb early, nil late(2)	2 lb early, 1 lb. late(1),(3)	Nil early, 1 lb late(3)
Meal used per 100 lb. dressed-weight gain	..	140 lb	200 lb	.	130 lb	200 lb		120 lb	40 lb	160 lb	85 lb
Weight range increase covered (dressed weight)	40 lb - 140 lb			80 lb - 140 lb			..	35 lb - 140 lb			..
Number of pigs ..	10	10	10	12	12	12	8	8	8	8	8
Carcass Efficiency	Percentage	Percentage	Percentage	Percentage	Percentage	Percentage	Percentage	Percentage	Percentage	Percentage	Percentage
*Streak	94	95	93	87	94	87	51	45	54	44	55
Eye of loin	51	52	54	60	60	60	46	46	51	51	47
Proportion of fat ..	86	73	57	90	80	75	40	34	65	50	69
Length of loin ..	29	19	18	39	33	32	4	0	7	3	3

(1) Whole period 50 lb – 200 lb live-weight. (2) Early period 50 lb. – 120 lb live-weight (3) Late period 120 lb – 200 lb live-weight

* Series A and B, Evaluation by measurement. Series C, Evaluation by standard photographs.

From the quality angle the belly region should not only be thick but should also contain a high proportion of lean meat. Since the latter is not shown up by a thickness measurement, the method of evaluation by standard photographs is considered the more satisfactory index of belly or streak quality(1). Detailed results by both methods are set out in Table VIII, which also shows the thickness of bellies measured on the uncut carcass as in commercial grading practice.

Table VIII.—Effect on Thickness and Quality of Streak, and on Belly Measurements.

Series and Group Number.	Supplementing-rate.	Streak Thickness and Quality (London). (Frozen Carcass.)			Belly Measurements (New Zealand). *	
		Thickness.	Marks(1).	Marks(2).	Middle.	Flank.
		SERIES A.				
	Lb.	Millimetres.	Percentage.	Percentage.	Inches.	Inches.
1	Nil	52	94	54	1·5	1·1
2	1	50	95	40	1·4	1·1
3	2	50	93	47	1·5	1·1
		SERIES B.				
1	Nil	45	87	65	1·4	1·1
2	¾	47	94	68	1·3	1·0
3	1½	46	87	63	1·4	1·1
		SERIES C.				
1	Nil	Not taken Comparison standard photographs more satisfactory. Index.		51	1·25	1·2
2	120			45	1·20	1·2
3	40			54	1·23	1·2
4	160			44	1·25	1·2
5	85			55	1·20	1·2

(1) Marks on measurement. (2) Marks on eye appraisal—standard photographs.

* Measurements as available for commercial grading—uncut side.

The average measurements both on the loin-cut and on the uncut carcass clearly illustrate the failure to influence the thickness of the streak by increasing the dry-matter content of the ration, even though the rate of supplementing was raised as high as 4 lb. of meal per pig daily during the later stages of fattening in Group 3 (Series A). Factory buttermilk as a sole source of diet not only produced bellies as thick as those from pigs receiving more concentrated diets, but the results recorded reach a high standard of efficiency.

The results throw considerable doubt on the theory that bulky diets are necessarily associated with thin bellies. With types of pigs similar to those used in these experiments, the author has not obtained significantly thicker bellies from pigs fattened on a completely meal diet.*

Neither rate of supplementing nor stage of growth of supplementing produced any effect on measurements.

On the other hand, though the results are not strictly uniform, the evaluation of streak on a basis of the proportion of fat to lean as well as on thickness (Marks 2, Table VIII) suggests that the use of meal has tended to increase the proportion of fat in the belly region. See also Plate II. This effect is in keeping with the increase in proportion of fat as measured in other parts of the carcass.

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* Unpublished data.

The thickness results are in agreement with recent work in England(10), where reduction in the water content of the ration failed to effect any significant improvement in bellies. In view of further work(11) which substantiates the practical farmers' belief that a fasting-period before slaughter improves the belly thickness, it must be noted that the pigs in these series were killed after a uniform fasting-period of twelve to sixteen hours. Incidentally the latter offers a more practical method of improving belly thickness by ensuring such a fasting-period than does the provision of special rations. Further, as pointed out in Part I of this paper, the slaughter of pigs at carcass weights of 140 lb. and over rather than at lighter weights can be of material assistance in avoiding excessively thin bellies.

If thinness of belly is associated with belly distension resulting from bulky diets, it is suggested that the negative results from these investigations are due to the fact that the use of supplements even at relatively high levels does not materially reduce the appetite of pigs for milk. This is a regular feature in New Zealand experience.

INFLUENCE OF DIET ON PROPORTION OF FAT TO LEAN IN DIFFERENT PARTS OF THE CARCASS.

The use of meal with buttermilk increased the proportion of fat in the carcass, and the higher the proportion of meal fed the greater was the deposition of fat. This effect is clear from the efficiency awards summarized in Table VII. Details of group fat-measurements in the loin-cut are set out in Table IX.

Table IX.—Effect on Proportion of Fat. Measurements on Loin-cut
(Frozen Carcass.)

Group and Series Number.	Average Carcass Weight	Fat Thickness (average).	Range in Fat Measurements.	Average Marks awarded.	Percentage possible.
		SERIES A.			
	Lb.	Millimetres.	Millimetres.		
1	137	25·4	20–32	17·0	86
2	138	27·4	24–34	14·5	73
3	140	31·0	20–36	11·5	57
		SERIES B.			
1	136	23·7	20–29	18·0	90
2	138	25·7	22–34	16·0	80
3	139	27·0	23–42	15·0	75
		SERIES C.			
1	146	29·0	25–37	8·0	40
2	146	29·6	24–36	7·0	35
3	146	26·0	22–29	12·5	65
4	142	28·0	23–38	10·0	50
5	147	25·75	21–27	14·0	70

NOTE.—Fat measurements taken on loin-cut at last rib, Series A and B at point of eye, and Series C at point 1½ in. in from middle line. Reference(1).

The extent of the increase in fat measurements was not great, but so undesirable is even a slight excess of fat in the commercial bacon carcass that the small increase recorded in the heavy-meal-fed groups was sufficient to produce significantly lower efficiency awards from the Committee. The uniformity of the effect may be judged from the photograph of the loin-cuts of the series showing the greatest effect.

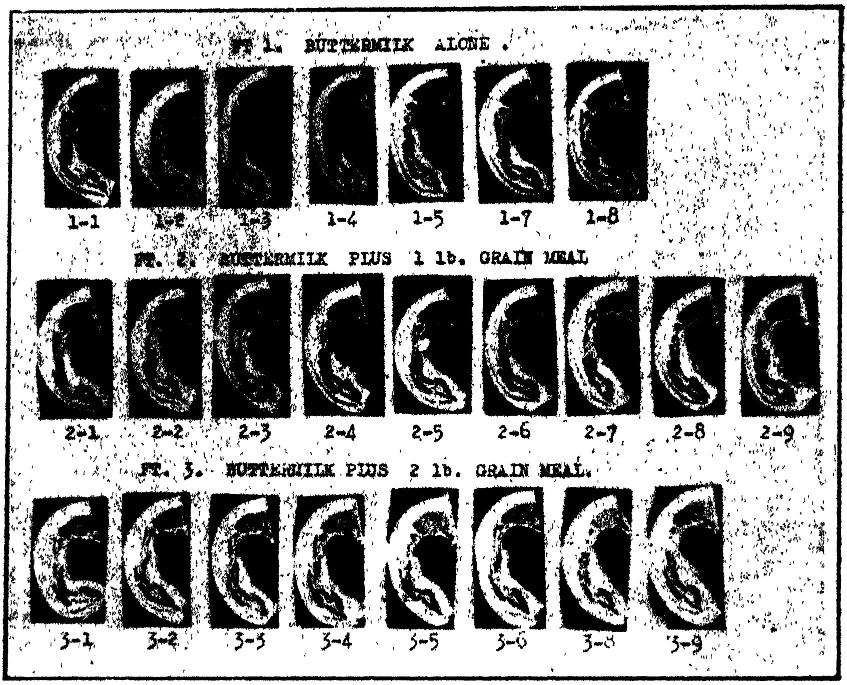

PLATE II.

Within each series the heaviest supplemented groups had a higher proportion of fat as indicated by the measurements on the loin-cut than both the light supplemented groups and the buttermilk-only groups, with one exception. The somewhat anomalous result of Goup 1 of Series C, the fat measurements of which are not in agreement with the tendency of the figures of the comparable groups of the series, nor with the results of the other two series, is rather difficult in interpret. Two points may be noted. A greater individuality effect was recorded in the pigs of each group of Series C than was the case with Series A and B, where the results were more uniform. This was specially marked in Group 1, and suggests that a more sensitive technique than the group-feeding system may be necessary to provide a conclusive finding on the point at issue.

Further, on theoretical grounds, and on the basis of a certain amount of evidence on the point(7, 12), the higher fat measurements of Group 1 might be attributed in part at least to a possible effect of very slow rate of fattening in the early stages, and rapid growth in the later stages(9) upon deposition of fat in the carcass—*i.e.*, accelerated weight-increase resulting from unlimited feeding in the final stages, following a long period of slow growth, might be mostly fat.

The results from Series C do not show any advantage from supplementing at any particular stage of growth, but rather indicate that the important factor so far as fat is concerned is the quantity of meal fed. Proportion of fat was also assessed by fat measurements along the back-line at the thickest point of the shoulder and the thinnest point over the loin. The carcasses were graded on a basis of these measurements according to the New Zealand official grading-scheme.

Table X.—Effect on Shoulder-fat Thickness and Commercial Grading Quality.

Group and Series Number.	Meal-supplementing Rate *	Back-fat Thickness at		Grading Quality.†	
		Shoulder.	Loin.	First Grade.	Second Grade.
		SERIES A.			
	Lb.	Inches.	Inches.	Percentage.	Percentage.
1	Nil	1·65	1·05	60·0	40·0
2	140	1·70	1·10	40·0	60·0
3	260	1·90	1·20	..	100·0
		SERIES B.			
1	Nil	1·60	1·38	58·0	42·0
2	130	1·65	1·30	42·0	58·0
3	200	1·75	1·37	34·0	66·0
		SERIES C.			
1	Nil	1·76	1·10	37·5	62·5
2	120	2·00	1·20	..	100·0
3	40	1·75	1·00	62·5	37·5
4	100	1·90	1·00	..	100·0
5	85	1·75	1·00	62·5	37·5

* Per 100 lb. weight-gain—dressed carcass. † N.Z. Official standards—grading on fat measurements only, taken on cold dressed carcass (N.Z.).

These results are in agreement with those taken on the loin-cut, a greater thickness of back-fat being associated with heavy rates of meal-supplementing, and the best measurements being shown by the pigs fed buttermilk alone. Little variation in fat over the loin existed. The variations in shoulder fat were responsible for a higher proportion of first-grade carcasses from groups fed buttermilk alone or supplemented at the lower rates. It is to be noted that the shoulder-fat measurements and grading results of Group 1, Series C, bring this group more in line with the related results.

In respect to this tendency for meal-supplementing to produce an increased proportion of fat in the carcass, several points of practical significance arise. The inherent tendency of New Zealand bacon pigs to carry too high a proportion of fat has been demonstrated in Part I. Any system of feeding which may accentuate this tendency is potentially dangerous on economic grounds. Yet other economic advantages of meal-feeding makes the limited use of supplements with by-products highly desirable. Rather than these investigations, therefore, suggesting the abandonment of a system of feeding with many husbandry and financial advantages(4, 9, 13), they point to the necessity for improvement in the type of pig in New Zealand to one capable of producing carcasses with the correct proportion of fat at bacon weights.

In view of the findings of Hammond(2, 5, 6, 12) on growth in pigs, it is not surprising that by accelerating growth with the early-maturing types of pigs used in these experiments the additional energy supplied by the meal was deposited largely as fat. The greater proportion of fat in all groups of Series C as compared with those of A and B was undoubtedly due to the excessively short pork-type pigs used in the former.

Finally, it is suggested that the results brought forward herein demonstrate clearly that the feeding of buttermilk improves the quality of bacon carcasses and that the excessive fat in New Zealand baconers is due more to the use of rapid-maturing pork-type strains than, as is commonly believed, to the feeding of pigs exclusively or almost exclusively upon dairy by-products.

INFLUENCE OF DIET ON FIRMNESS OF FAT.

The quality of the fat as well as its quantity is a factor of considerable importance in the carcass-quality of bacon pigs. The fat should be as hard as possible because soft fat readily becomes rancid. A hard fat is particularly essential in carcasses which have to withstand the strain of long periods of freezing and storage(3) as do pigs from New Zealand destined for the United Kingdom market. The following table gives details of the iodine values obtained in England from the pigs of Series C.

Table XI —Quality of Fat Hardness.

Series C Group.	* Iodine Numbers of		Meal fed per 100 lb. Carcasses.
	Frozen Carcasses.	Cured Bacon : Fat.	
			Lb.
1	57·5	55·2	Nil
2	57·3	58·6	120
3	57·7	55·6	40
4	57·4	56·7	160
5	57·0	56·0	85

* Composite group samples.

These iodine values are in all cases markedly lower than those quoted elsewhere for pigs fattened in other countries. They show that buttermilk produces a firm fat, and that the firmness is not reduced when the milk is supplemented with meal up to 2 lb. per 100 lb. live-weight daily. They also clearly demonstrate that New Zealand pigs have definite advantages for storage in case of necessity.

SUMMARY.

Experiments carried out with over a hundred pigs divided into groups and fed, in addition to unlimited supplies of factory buttermilk, quantities of meal varying from nil to 2 lb. per 100 lb. live-weight daily, show that—

(*a*) The addition of meal to a buttermilk diet does not increase the thickness of belly :

(*b*) There is no evidence that thinness of belly is attributable to feeding unlimited supplies of buttermilk :

(c) Buttermilk produces carcasses with a lesser proportion of fat than buttermilk supplemented with meal, but this feature is not marked when the meal fed does not exceed a rate of 1 lb. per 100 lb. live-weight daily :

(d) The type of pig exerts a greater influence than the type of diet on the proportion of fat to lean in bacon carcasses :

(e) The fat of pigs fed on buttermilk and buttermilk plus meals is particularly hard.

ACKNOWLEDGMENTS.

In a project of this magnitude it is impossible to acknowledge adequately all those who necessarily played an essential part in the work. Particular thanks are due to Mr. W. J. Croucher, Recording Officer, Manawatu-Oroua Pig Development and Recording Club, for most valuable and extensive assistance, mention of which was made in Part I, and to the members of the New Zealand Pig Carcass Evaluation Committee, Messrs. Hammond, Davidson, Swain, and Wright, for their invaluable co-operation and assistance at the London end. The work would also have been impossible without the active support of the following organizations : Kiwi Bacon Co., Longburn ; N.Z. Co-operative Pig Marketing Association , Cheltenham Dairy Co ; H. R. Lane and Co. ; Jos. B Swain and Co. ; Smithfield, Empire Bacon Co., Newcastle ; N.Z. Department of Scientific and Industrial Research. Special thanks are due to farmers who supplied pigs and necessary information, and to Mr. A. Webb, of the Kiwi Bacon Co., Mr. H. E. Thurston, of the Cheltenham Dairy Co., and to Professor W. Riddet, all of whom were of material assistance in planning and organizing the work.

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GRADING OF MALTING BARLEY IN NEW ZEALAND.

Fields Division.

GROWERS of barley in New Zealand have long desired the setting-up of definite standards as a basis of barley sales, but until 1936 little or no concerted effort on their part was made to bring this system about. However, following the 1936 harvest, a definite move in this direction eventuated which resulted in a meeting of representative growers in Christchurch in June, 1936, urging Government fixation of prices and official grading.

It is obvious that, unless there is very keen competition between maltsters for the produce of any district and the absence of any alternative source of supply, a basis of sale in which the buyer is the sole judge of quality falls far short of the ideal. For some years past this element of competition has become a diminishing factor by reason of amalgamation of brewing interests. The proximity of the South Australian market, from which very large quantities of malting barley have been imported of recent years, has further restricted competition. In Table A a statement of the importations during the past six years shows clearly the growing tendency on the part of maltsters to rely on this source for their requirements.

Table A

Calendar Year.	Imports of Malting Barley.
	Bushels.
1931	11,992
1932	20,814
1933	81,060
1934	88,184
1935	161,628
1936	265,638

Action taken by the Government to curtail imports and the introduction of the compulsory contract system, whereby maltsters are required to arrange contracts to cover their requirements, will do a great deal towards altering matters in this respect.

While the curtailment of imports and the contract system will improve the position for barley-growers, it has been the policy of the Government to explore the possibilities of grading to defined standards. This problem is, however, one of some magnitude, and it may be well to survey the position in other countries.

In a report submitted in 1936 by the Standards Association of Australia to the Commonwealth Council for Scientific and Industrial Research on the subject of Standardized Grading of Primary Products the barley-grading practice in several countries is briefly reviewed.

United States of America.—The grade requirements are based upon weights and percentages of sound barley, heat-damaged kernels, foreign matter, broken kernels, black barley, and wild oats.

Canada.—The grades (3) for malting barley cover minimum weight per bushel, minimum percentage of varieties or type, "sound" quality and maximum limits of seeds, wild oats and other grains.

Germany.—Groups (3). Set percentages of foreign bodies (including weeds), other grains, broken and crushed grain, sprouted grains, moisture content, and germination capacity.

U.S.S.R.—Grading is based on external characteristics and analysis. External characteristics take cognizance of smell, taste, and insect-infestation. Analytical characteristics cover uniformity of size (Fogel apparatus), farinaceous and half-glassy grains, weight per 1,000 grains, sprouted grains, germination energy, moisture content, and albuminous content.

Argentine.—Grading is based on condition of grain, minimum weight, percentage of "feed" barley, wild oats, foreign matter, stained, skinned and broken, heat-damaged, sprouted, smutty, and weevil-infested grains.

Great Britain.—The position in Great Britain is somewhat obscure. Apparently buyers have quite definite standards, based upon external characteristics such as feel, smell, &c., upon which they work. No allowances are fixed for such analytical points as purity, germination, moisture, &c., though probably these points are taken into consideration. Information is not available as to the extent, if any, to which analytical standards could be applied to barley-grading as the result of work which has been carried out by the Institute of Brewing during the past eleven years. There is evidence, however, of a tendency to attach a good deal of significance to nitrogen content, although admittedly this factor is still (as for the past thirty years) too complicated to be yet adopted as a sole indicator of suitability. From a knowledge of the nitrogen content of a sample of barley it appears to be possible to forecast with reasonable accuracy the potential yield of extract from the line This information is very important to the maltster, especially when he is dealing with barley which he knows to be of a suitable type. Where the nitrogen test seems to fail is that it gives no indication of the quality of the malt which will result.

The difficulties confronting the English worker are perhaps somewhat modified in New Zealand, as we have for all practical purposes only two varieties of malting barley, and the differences of soil and climate and the reaction of these factors on the quality of the grain are not pronounced as in Great Britain, where barley is received from such widely divergent sources as California, Northern Africa, Persia, Czechoslovakia, and India, in addition to their home-grown barley. Work along the lines of nitrogen percentages and based on British findings to date should be well worth while in New Zealand.

Australia.—Reference has previously been made to the report of the Standards Association of Australia. This report, after considering the arguments for and against standard grading, reviews the Australian position as follows:—

> "It is quite apparent that in the opinion of the majority of those consulted there would be problems to be encountered which would make the institution of a system of standard grading of malting barley a most difficult, if not an impossible, undertaking. The impracticability of defining accurately and adequately in a

written description those qualities which would be regarded as the criterion for approval for a grade classification is by no means an unusual difficulty in standardization experience.

" In some instances it is possible to prepare a standard of grading which, while requiring some supplementary means of quality determination such as actual tests in use, are nevertheless of unquestionable benefit and assistance. The standard grading may provide the preliminary determination for approval, and, by doing so, eliminate a large proportion of the sub-grade samples. In other words, all those samples which fail to pass the tests and visual examination provided in the standard would be unsuitable for acceptance, but some of those which pass the standard requirements would not be suitable and would require to be eliminated subsequently by a supplementary means of determination.

" Sometimes this supplementary check is in the form of a standard sample, and the product is required to be similar to or of quality equal to the standard sample in respect of features not specifically recorded in the standard specification.

" A standard which is dependent upon accessory determinations would indicate but would not specify in detail the supplementary approval that would be necessary. Whether such a type of standard is likely to be of any value depends upon the conditions relating to the product under consideration.

" In other instances the only specific requirements that it is practicable to record in a written specification are so limited in extent and of such restricted value that it is definitely not worth while endeavouring to apply a standardized grading until human knowledge on the subject in question has been greatly extended. It is wiser in such cases to defer attempts at standardization and to encourage research with a view to the desired extension of knowledge.

" It is a matter for careful judgment as to the practicability of drafting a grading standard for malting barley which would be of value either as a partial or a complete guide for determination of quality.

" Much has been said regarding the impossibility of applying a standard grading because of the diverse requirements of various users. Again quoting from standardization experience this may or may not be a valid objection. A standard grading may fix the requirements for a single grade of approved quality, or it may determine a range of grades suitable for a variety of purposes in use. The range of grades may be unlimited in extent, and it is common practice with regard to grading either of primary or manufactured products to provide for multiple grades. Obviously, however, if the number of grades be extended too greatly, the advantages of standardization are largely forfeited and the system may become cumbersome and economically unsound.

" In the case of malting barley, therefore, the question to be answered is whether the number of grades customarily required by the user is small enough, or could be sufficiently curtailed without detriment, to permit the adoption of a reasonable range of standard grades.

" The argument that the present practice is so firmly established that a drastic change of practice would be vigorously opposed is a difficult one to combat. It is the problem of overcoming the inertia of conservatism If the proposed change of practice would definitely be advantageous it is necessary to consider whether the inertia may not be overcome, either by the gradual penetration of new ideas or by a measure of control in the public interest. Before such steps are taken, however, there should be very real conviction that the benefits to be derived warrant the effort.

" An important feature of the discussions on this problem is the distinction between the conditions governing purchase for the Home market and conditions of oversea trading. A standard grading might conceivably be justified for one and not for the other.

" Perhaps the most significant of all the features of this inquiry is the conflict between the claims as to impracticability of standard grading and the fact of the existence of systems of standard grading, not only in other countries, but also in Tasmania. This contrast appears worthy of careful consideration as to whether the practice of standardized grading as recorded is found satisfactory, and, if so, whether equal satisfaction could be assured in the application of a standard to the marketing of all barley produced in Australia or possibly to the export only of barley from Australia."

Table B.—Grades of Malting Barley

The maximum allowance permitted in each grade shall be as under (all percentages being in terms of weight) :—

	No. 1 Grade Superior shall be dry, plump, bright, sound, clean, and free from other Grains	No. 1 Grade shall be dry, plump, bright, sound, clean, and free from other Grains	No. 2 Grade shall be dry, plump, sound, reasonably bright but not stained, reasonably clean, and free from other Grains	No. 3 Grade shall be dry, plump, slightly stained and reasonably free from other Grains.	No. 4 Grade must be reasonably dry, plump, and reasonably free from other Grains; may be stained and weathered.
	Per Cent	Per Cent.	Per Cent	Per Cent	Per Cent.
Flinty grain	0·5	0·5	0·5	0·5	0·5
Foreign matter (weeds, chaff, straw, &c.) ..	0·5	0·5	1·0	2·0	2·0
Wild oats	0·5	0·5	1·0	2·0	2·0
Skinned and broken grains	2·0	3·0	4·0	5·0	5·0
Tares and other round seeds	5·0	5·0	5·0	5·0	5·0
Sprouted grains	Nil	Nil	Nil	Nil	3·0
Moisture	15·0	15·0	15·5	16·0	16·0
Bushel weight	52 lb	52 lb	51 lb	50 lb	50 lb
Disease	Trace	Trace	Trace	Trace	Trace

Prior to grading all barley shall be screened through a 6A screen. The maximum amount of screenings permitted for malting barley shall be 20 per cent. Screenings under 20 per cent. shall be subject to dockage at the rate of ½d. per bushel for every 2 per cent. over 5 per cent. On tares and round seeds left in the screened sample there shall be a dockage deduction on a weight-percentage basis at the rate of ½d. per 1 per cent.

The maximum district price is payable in respect of No. 1 Grade Superior only. The price for No. 1 Grade is 1d. per bushel lower, the price for No. 2 Grade is 3d. per bushel lower, the price for No. 3 Grade is 6d. per bushel lower, and the price for No. 4 Grade is 9d. per bushel lower than the maximum district price in each case.

New Zealand.—Under no misapprehension of the difficulties of the problem and conscious of their limited knowledge of the subject, officers of the Department tentatively explored the possibilities of establishing standard grading for New Zealand. They were encouraged by the fact that the bulk of malting barley was purchased by two firms and that there was reasonable conformity in the whole of the malting barley produced in the Dominion. It was finally decided that there was a reasonable chance of setting up successfully standard grades, based partly on appearance and partly on physical determinations. The Government decided that barley grading *for those lines in dispute as to quality between buyer and seller* was practicable, and a Committee was set up to formulate mutually acceptable standards for adoption as official standards in such cases. To this extent only have malting-barley standards been adopted in New Zealand. It is hoped during the coming year to secure evidence as to the efficacy of the standards set up.

The Committee was as follows:—

A. Anderson, Leeston	Representing growers.
J. H. Gordon, Garston	
J. H. Hewlett	Representing maltsters.
A. B. Duncan	
R. B. Tennent (Chairman)	Representing Department of Agriculture.
J. M. Smith	
F. E. Cameron	Committee Secretary.

The standards are given in Table B. It should be pointed out, however, that while No. 1 Grade Superior is the objective towards which the grower should aim, we have no knowledge that such barley is the most suitable for *all* malting purposes.

Research Work.—Much work can be done by way of manurial trials in relation to soil types and climatic conditions, investigating the disparity in yields in the various growing districts, and kindred matters. If this work could be supplemented by or co-ordinated with analytical and bio-chemical work there is no doubt that considerable improvement could be effected. The work would perhaps not bring about immediate results, but in the long run—especially if close contact with overseas institutes were maintained—there appears no reason to doubt that it would prove its value to the industry. The initial expense would be heavy—it would probably be necessary to construct and equip a small malthouse and laboratory, &c.—but the problems confronting the industry are many and our present knowledge meagre. How could it be otherwise? Workers in Great Britain after years of specialized research are still far from understanding the full significance of many factors.

—*F. E. Cameron, Secretary, Barley Advisory Committee.*

Check-testing Suppliers' Milk and Cream Samples at Dairy Factories.—During the year check tests numbering 440 were carried out by Divisional officers. A pleasing feature of the testing as carried out by the dairy companies is the very few variations found between the factory results and the check tests. It is now the exception for the Division to receive samples of milk or cream from suppliers for check-testing, which is an indication that the factory testing is being carried out on approved lines and that suppliers generally are satisfied with the general accuracy of the factory tests.—*Annual Report, Director of the Dairy Division.*

DESTRUCTION OF ANT-NESTS IN BOWLING-GREENS.

ANTS are common in soil throughout the Dominion, and are quite frequently found in lawns. The treatment recommended is the use of carbon disulphide or of calcium cyanide in the dust form. To apply carbon disulphide, punch holes in the soil about the nest to a depth of 8 in. to 12 in., depending on the size of the nest. Into each of these holes pour about one tablespoonful of carbon disulphide and cover the top of the hole with moist earth. It is a good plan to cover the top of the treated nest with wet sacking. It must be remembered that carbon disulphide is poisonous and inflammable, and the fumes must not be breathed or a light of any kind allowed near: even smoking must not be allowed near the scene of operations.

Calcium cyanide, in the dust form, may also be used for destroying ant-nests. This is best applied to holes made in the soil in and around the nest. Several holes should be made 2 in. or 3 in. apart. The cyanide should be applied with a funnel, a teaspoonful to a hole, putting it only in the bottom of the holes. Fill the holes with earth immediately after application of the cyanide, which, if scattered over the surface of the ground, is likely to kill the grass or other plants. Calcium cyanide and the gas from it are very poisonous, and care must be used in handling it.

—*Horticulture Division.*

In general, New Zealand farming has to face steadily increasing competition from other agricultural countries upon our export markets. One of the most effective means of meeting this competition is improvement not only in the quality of our export products, but in the quality of all those other farm-products upon which the quality of our export products at times depends. There is scope also for improvement in the handling of our products.—*Annual Report, Minister of Agriculture.*

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SEASONAL NOTES.

THE FARM.

Provision of Reserves of Feed.

THE report of the Dairy Industry Commission, 1934, contains the following statement: "It can be fairly stated that the quality of our dairy cows at the present time is, on the average, better than the efficiency displayed in their management and feeding." In practice this statement has been given much less attention than it warrants. It enunciates a truth which much evidence from the field shows is applicable equally to our sows and to our breeding-ewes. This truth provides important guidance in the drawing-up of a programme of the work of the coming year in respect to the provision of special feed. At this season with distinct advantage such a programme may be drawn up tentatively; although it is likely to be advisable to modify such a programme later because of developments which could not have been foreseen, it may be expected to be of service in the meantime in the making of decisions about such matters as the location of fences and of silage pits or trenches and the arranging of cultivation work, all of which should be planned as soon as possible so that labour may be provided for them from now onwards as opportunity offers.

Useful guidance in drafting a programme of special feed provision lies in the fact that in the past provision as a rule has been distinctly inadequate. Inadequate supplies of feed to supplement that available directly from pastures in winter and early spring usually lead to two distinctly undesirable results, one of which, while much less obvious than the other, is probably more serious. The more obvious of these results is a poorer return from live-stock, frequently due in part at least to greater incidence of disease. Important aspects of this relative to sheep-farming were discussed in this column in February last, while in regard to dairying it must suffice now to state that there is a general agreement that losses from a wide range of troubles are magnified as the result of poor feeding in winter and early spring—*e.g.*, losses due to udder troubles and to internal animal parasites.

Poor Feed-reserves Inseparable from Poor Utilization.

The other serious though generally not so apparent result originates in the fact that inadequate provision of reserves of feed for use in the winter and early spring is inseparable from poor utilization of that grassland: if such reserves are too meagre the farmer is forced either to overstock his pastures in winter and early spring or to understock them in summer or, what is more common, both to overstock and to understock them at the respective seasons specified. In all three cases poor utilization is an inescapable result. To understand the full bearing of this it is necessary to recall that recent important advances in our knowledge of grass-farming relate to the basic importance of utilization of feed from grassland as a factor governing the returns from that grassland. Hanley, of the School of Agriculture of Cambridge University, touches on one aspect of this matter in the January, 1937, *Journal of the Ministry of Agriculture*, England, in stating:—

"Though fertilizer applications can do much to ensure a satisfactory amount of good-quality herbage, other points in management, especially the density and periods of stocking, have frequently a much more immediate and pronounced effect on the productivity of a pasture."

Outstanding Importance of Utilization.

In New Zealand farming the concept involved in the statement is a momentous one, which already has been confirmed fully in New Zealand experience. It is momentous because it calls for the development in many of us, and maybe in the majority of us, of a changed outlook. This changed outlook would lead firstly to our not concentrating attention so completely upon what may be termed "direct" means of increasing the productivity of grassland—*e.g.*, top-dressing, the use of better strains of pasture species, &c., and secondly to our giving greater attention to the method of utilizing the growth of grassland with the dual objective not only of making most effective use of current growth but also of fostering future growth as fully as possible.

And this brings us back again to the fact that, if the reserves of feed for winter and early spring are inadequate, it is possible neither to make the best use of current growth throughout the year nor to foster the fullest future growth. Inadequate reserves of winter feed lead to overstocking or understocking as already indicated overstocking at best means that too large a proportion of feed is used solely for maintenance; understocking means wastage.

There remains for consideration the effect upon the pastures themselves. The joint influence of overstocking and of understocking at the respective periods mentioned is weakening of a species which grows when the grazing is severe and strengthening of a species which grows when the grazing is lenient. In practice over wide areas the result is a weakening of the early developing rye-grass and strengthening of the late brown-top and sweet vernal Unfortunately, examples are altogether too readily available

Measures to improve Reserve-feed Position.

A most valuable and effective means of improving the feed position is conserving the surplus of summer feed in the form of silage or hay. In some cases, however, there has been a tendency to place too much dependence upon the reserves of feed that actually are built up in the form of silage. To this matter there are three distinct aspects that require consideration. In the first place, because of weather vagaries from year to year, there is no certainty whatever that in next summer there will be enough surplus grass-growth to give reasonably safe supplies of silage. In the second place, on account of various factors, human and otherwise, assuming an adequate surplus of grass-growth for the purpose under consideration, experience teaches us to expect a marked disparity between the potential reserves of silage and the actual reserves. It may be contended that the disparity is due to faulty management, but for practical purposes the crux of the position lies in the fact that such a disparity is customary and so must be allowed for in any planning that professes to cover the position as it is as distinct from the position as it might be or as it should be. In the third place, ensilage as commonly carried out gives feed that fails in respect to the quality required for certain important purposes in dairying—*e.g.*, the feeding of cows in late summer and the feeding of pigs with farm-grown material when the supply of dairy by-products is inadequate. Because of these and other facts most farms, including those on which ensilage and hay making are given a prominent place, could profitably undertake some special cropping for the purpose of creating reserves of feed.

Judicious top-dressing, which was discussed at some length in these notes last month, is considered briefly below in part of its relation to seasonal supplies of feed.

Special Supplementary Crops.

Of current importance in regard to crops grown specially to supplement pastures during critical feeding periods is the fact that the mangel, which is of especial value, when sown after grass often gives the largest and most profitable crops, and this especially when ploughing about May is practised. Ploughing at this stage assures enough time for the thorough decay of the buried sod, and this decay gives a more fertile and tractable soil. If ploughing at this stage is not practicable it becomes necessary to carry out in the spring a skim-ploughing followed by a deep-ploughing, or, alternatively, a disking of the sod before deep-ploughing.

Late autumn or early winter cultivation, in preparation for such crops as carrots, lucerne, and potatoes, is frequently well justified, especially when these crops follow old pasture. A main objective of such cultivation should be the thorough breaking-up of the sod, and this usually may be effected suitably by skim-ploughing followed by disking, which in turn is followed by a normal deep-ploughing in the spring.

At this stage it pays to base procedure on the well-established fact that a common cause of unprofitable yields of the crops under consideration is inadequate preparatory cultivation. Hence in districts in which the amount of arable cropping carried out is substantial, no opportunity should be missed of cultivating the land in preparation for spring sowing. In this respect it may prove of assistance to bear in mind that old lea land can sometimes be cultivated safely when nearby similar land which has been under the plough recently is too wet for satisfactory results from cultivation.

Pre-winter Top-dressing.

What takes place in the case of good well-top-dressed pasture at Marton does not differ radically from what takes place in the case of similar pastures in much of the North Island Work done at Marton shows that for several weeks in winter the daily production of pastures probably is not greater than 8 lb. to 10 lb. of green herbage an acre. Merely to maintain herself alive without loss of weight the average dairy cow requires approximately 30 lb. of green grass herbage or its equivalent daily, and if she is producing butterfat she requires an additional 30 lb. to 60 lb. of such feed daily according as her production ranges from 200 lb. to 400 lb. of butterfat a year. These data which enable pasture-production to be compared with feed requirements at the periods mentioned are useful as an indication of the extent to which good, well-manured pastures meet or rather fail to meet the needs of stock during the period of low growth in winter. They are useful also as an indication of the advisability of carrying out pre-winter top-dressing well ahead of the season of low growth so that the fertilizer stimulates the pastures while they are still making growth rapidly enough to give an increase of real practical moment. What seems not to be realized sufficiently is that pre-winter top-dressing carried out close to the period of really low winter growth does not materially affect the winter supply of feed, whereas similar top-dressing carried out some weeks earlier may substantially improve the winter-feed position. From this it follows that where pre-winter top-dressing has not been done already it should be proceeded with as quickly as possible. In short, in our grass-farming we should give greater consideration than generally we seem to give to the really small quantity of herbage actually grown even with the assistance of top-dressing during the winter period during which warmth is the dominant factor determining the rate of growth.

The Cereal Crops.

The guidance relative to cereal crops tendered in these notes last month applies generally to matters calling for attention in April and May. The treatment of the seeds of cereals for the control of certain diseases seems not to keep pace completely with recent advances in such treatment. As these advances beget safety and convenience in the work without making it unduly expensive, those who are not yet putting them into application certainly should consider carefully the advisability of doing so. Full information about such seed treatment is obtainable from officers of the Fields Division.

Autumn Utilization of Crops.

Because of their immaturity, and especially because this year conditions have been favourable to the development of attacks of internal parasites, calves and hoggets are likely to suffer severely and maybe to be permanently stunted unless they receive good treatment from now onwards for some months. Worms are of common occurrence, and are often present in stock without doing any apparent damage, while at other times they do great damage. Hence there must be more than one cause operative before worms cause serious damage. In support of this there is much experience both in New Zealand and overseas which points to the conclusion that worms much more readily cause grave trouble in stock which are not looked after well Stock should not be allowed to get into a low condition before they are given good treatment Hence young stock should be trained to eat such material as silage and hay while they are still in good condition and thriving, and before they will be called upon to live almost wholly on these unfamiliar feeds, a gradual introduction to which assists valuably in avoiding the set-back at times suffered by stock subjected to sudden changes in feeding. Hoggets being fed largely on standard special fodder crops such as turnips should as a rule be given a run-off on suitable pasture—one which is short, clean, and fresh

It is significant that some who consistently have been successful with lucerne adopt the practice of having growth a few inches in height on the lucerne area at the beginning of winter. Such a growth is of value in checking the development of seedlings of those weeds which are capable of outgrowing lucerne when the temperature falls below a certain point the foliage on the lucerne checks such seedlings to the extent that it deprives them of a supply of direct sunlight. Further, if the growth on lucerne is removed just before winter some fresh growth usually takes place. This is a drain on the crop which weakens it, and this weakening is specially undesirable in those many cases in which lucerne requires its maximum strength to be successful in the competition with invading plants that regularly takes place in the spring Should a lucerne area be invaded heavily with useful plants such as rye-grass, cocksfoot, and clover, it may quite well be sound practice not to try to free it from such invaders, but to treat it as a pasture from which it may be possible to obtain annually two or three cuts, to some or all of which the lucerne contributes substantially.

Care of Young Pastures.

At this season care should be taken to avoid both too lenient and too severe grazing of young pastures. The most beneficial grazing of young pastures usually results from stocking with a relatively large number of animals for a short time. This avoids the undesirable selective browsing of the more attractive species which may take place under light stocking. Too lenient grazing is likely to be harmful when a quickly developing temporary species such as Italian rye-grass is very prominent or even fairly prominent in the pasture: such a temporary species is likely to outgrow the valuable slower permanent species and to injure them by shading.

—*R P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Harvesting and Storage of Fruit.

DURING the coming month picking, packing, and marketing of apples and pears will continue to engage the attention of the fruitgrowers. Every care should be exercised in the handling of the fruit so as to avoid the damage and subsequent deterioration which is caused through rough handling and lack of judgment in the picking. At this time of the year the fruit is frequently wet with rain or dews. As far as is practicable the fruit should not be gathered until it is perfectly dry. This point is more important in respect of fruit which it is intended to store for a time. Only sound, mature fruit should be placed in storage. Growers who have mid-season varieties stored in their sheds should examine the fruit at frequent intervals, and immediately it shows indications of "going off" no time should be lost in placing it on the market. Fruit which should be marketed at once is frequently held until it has deteriorated considerably. As a result of its condition of advanced maturity in conjunction with the handling, such fruit invariably arrives at the market in an almost unsaleable condition, which leads also to waste. Such late-maturing varieties as Statesman, Rome Beauty, Tasma, Sturmer, &c., which are firm-fleshed, will, with proper treatment, keep longer than mid-season varieties. In consideration of this, in the main, varieties of this class should be given preference in the matter of cold storage. Delicious, although classed as a mid-season variety, holds well, as a rule, in cold storage. A cool, even temperature should be maintained, moderately dry, but not sufficiently dry to cause the fruit to wilt. In situations at the orchard where the average daily temperature is not low at this time of the year, and when there is considerable fluctuation between the day and night temperature, fruit intended for long storage should be placed in a cool store. It is advisable to repack stored fruit before placing it on the market, as there are usually some fruit affected with storage rots, and these fruit, if not removed, will cause a considerable reduction from the price otherwise obtainable.

Late Spraying.

Following the completion of the harvesting it is advisable to spray stone-fruit at leaf-fall—*i.e.*, when the leaves commence to show autumn tints and to fall—with Bordeaux 5-4-50. For the better control of brown-rot, leaf-curl, die-back, &c., stone-fruit trees should be examined carefully and all cankered and infested shoots, laterals, branches, and mummified fruits removed and destroyed by burning, for in such tree-parts the fungous diseases over-winter.

Drainage.

Good drainage is very important. The drainage of heavy retentive soils should not be neglected. Tile drains, though more expensive, give the best results, and are the most convenient and permanent type of drain for the orchard. Existing open drains should be cleaned and put in order so as to enable the drainage water to pass away freely.

Ploughing and Manuring.

The orchard should be ploughed as early as possible after the fruit crop is harvested, so that the work may be completed before it is too wet for working.

In circumstances where a green crop has been sown and has not reached a sufficient height, it is as well to delay the ploughing for a while, to obtain the benefit of any additional growth the crop may make during late autumn and early winter. The soil is greatly benefited by being exposed to the winter frosts and rains. To facilitate the surface drainage the land should be ploughed with the fall, and not across the slopes. Plough to the trees, leaving an open furrow along the centre of the land between the rows of trees.

It is recommended that deep-ploughing should be done, towards the centre of the rows, in autumn, as the effect of any injury to the feeding roots at this time of the year would be less than when the trees are in growth. When ploughing close to the trees shallow-ploughing is advisable, as otherwise serious damage to the root system may occur, which would result in a considerable check to the growth of the trees.

Applications of phosphatic and potassic manures may be made during the autumn just prior to the ploughing of the land. Soils requiring lime may be top-dressed with approximately 1 ton of carbonate of lime per acre. The application of the quickly acting nitrogenous fertilizer may now be delayed until the spring

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus Culture.

By the time these notes appear in print the month of April will be practically over so that winter weather conditions will be close at hand, if they have not arrived already. In the notes for almost every month mention has been made of the application of sprays -Bordeaux mixture, summer oil, &c.—and it is just possible that critical readers may say that according to the writer one should be spraying almost continuously. This, of course, is exaggerating the case, although it would be safe to say that owing to the unfavourable weather conditions which have prevailed during the past two years, particularly with regard to the incidence of fungous diseases, more than the usual amount of spraying has been necessary. These notes are intended to be a guide and a reminder for the work which may be expected to be necessary under certain conditions. It is for the individual grower to work out and adopt his own programme to suit the particular requirements of his own grove. The local Orchard Instructor is always available to assist with advice if required. Although it is advantageous to exchange views with one's neighbours it does not necessarily follow that the same time-table and spray programme should be carried out unless all conditions are identical. A few basic principles which may be used in determining the disease-control programme are --Prevention is easier and less costly than cure; spray applications if applied at the correct strength and at the right time are good insurance against loss of crop, and thus loss of the whole year's labour; thorough work is absolutely essential, as also is an efficient spraying plant, the trees should be kept in a condition which makes good crops a reasonable certainty, not a doubtful possibility.

Apart from spraying, however, there are often other matters in connection with disease-control which require the careful consideration of the grower. One of these is drainage. Instances have come under notice of patches of orchard containing a few trees which were always infected with fungous disease while the balance of the orchard was clean. Investigation revealed the fact that in these patches the soil was water-logged, and in hot weather the humidity around the trees was excessively high. Improvements in drainage eliminated the trouble. It may be that, in cases where it is particularly difficult to control fungous diseases, the drainage of the whole orchard is poor, in which case extra money spent on improvements in this direction should be well repaid by better fruit and reduced spraying-expenses. Physiological diseases, such as die-back, are often caused by poor soil drainage. Lack of shelter is often the indirect cause of a fungous disease, wither tip, which does considerable damage to the foliage, twigs, and fruit. The fungus gains entry to trees which have become low in condition. Several instances have occurred of a bad outbreak in young trees which have been exposed to high winds. Attention to the matter of improving shelter is thus an important part of disease-control. However, it is possible for shelter to be overdone, and an endeavour to obtain the happy medium of shelter from damaging high winds while maintaining sufficient air circulation to reduce humidity should be aimed at. From the foregoing it will be seen that, apart from spraying for the control of disease, careful attention must be given to other important factors, and it is suggested that this time of the year, when the pickings are not yet heavy and the soil is still workable, is appropriate for action in this matter.

Frost protection is a problem which must be considered by nearly all citrus growers in this country, since there is not a very great area which is frost-free. Here again the matter must be investigated thoroughly by each individual orchardist, as even adjacent groves vary considerably in their liability to frost. While damage to citrus trees in New Zealand is often measured only by the amount of injury done to the young wood, there is evidence that more serious, though often not so noticeable, harm is done to the crop, particularly in the case of lemons. Severe frosts, of course, cause a dropping of fruits and foliage, but lighter ones cause premature colouring, a slowing of the growth of the fruit, and often extensive blemishes which reduce the grade of the fruit. Through the failure of the fruit to " size up " normally, its natural life has been almost expended before it is picked, with the result that keeping-quality suffers, and this is reflected by the increased amount of decay in curing-rooms at the period when the bulk of the frost-injured fruit has been picked. The avoidance of this trouble may play a definite part in the production of better fruit. Unfortunately, whereas deciduous trees while dormant are able to stand most of the frosts of winter, and require protecting only against one or two which generally come at the critical fruit-set time, citrus trees, provided the frosts are severe enough, are liable to damage over the whole period of winter : this makes the task of protection much more costly and difficult. There are some growers who have successfully carried out orchard-heating, while others who have purchased oil-pots have thrown them aside after a trial or two and given the job up. The nature of frosts varies so much from orchard to orchard and from time to time that even those who are more or less prepared are taken unawares at some period or other, and the expense and hard work of the other occasions are nullified. In places the drift of cold air is so great that it is difficult to keep the heated air over the orchard, but this same drift, provided there is a ravine or gully alongside the grove, is the means of saving the situation, as the cold air is drawn off into these gullies, where it settles and causes there a hard frost, while the orchard escapes with a much lighter visitation. In localities where there are no lateral air currents and the cold air stays close to the ground, thus, while a very low temperature may be recorded on the grass, that of the air up in the trees is several degrees higher and no damage is done. In still other cases the movement of the air is sufficient to bring the cold layer well up into the trees, and damage results. Altogether the difficulties and uncertainty of protecting citrus orchards from frosts are such as to encourage many growers to trust to luck and hope for the best. In spite of the difficulties, however, the benefits to be derived from frost-protected citrus orchards are such that it is to be hoped that some cheap yet efficient method may be evolved in the near future.

Pruning.—The ordinary cutting-back of light spent laterals to more vigorous wood may be continued as opportunity offers, either during picking or in spare time, but as winter is now close at hand no really heavy cutting-back should be done until spring. Skeletonizing citrus trees in the winter-time may cause severe damage.

Brown-rot.—The month of May has often proved to be a time for considerable development of brown-rot, and therefore growers should see that all trees have a good covering of Bordeaux mixture 3-4-50. Spray residue from a previous application, such as the one for the protection of the autumn setting from verrucosis, may still be visible on the trees, but the efficiency of a Bordeaux spray should not be regarded as extending for more than a month at the outside, while under excessively wet conditions it might be reduced to less than half that time. The practice of spraying only half of the tree for protection from brown-rot is not to be recommended, since total coverage may still be necessary against other fungous diseases, and if the 1-per-cent. oil has been added the insecticidal value is also obtained throughout.

Young Trees.—Special attention should be paid to these to see that they face the winter well protected from the elements—cold winds and frosts. If windbreaks are not yet adequate the expense of individual protection of small trees will generally pay well. Scrim, brushwood, or fern can be utilized for this purpose not only for protection from wind, but also from frost. A bad setback may mean an additional year without revenue, and sometimes trees are lost altogether through outbreaks of disease following low condition contracted during the winter.

A. R. Grainger, Orchard Instructor, Tauranga.

POULTRY-KEEPING.

Management.

As good management is "the skilful or prudent use of means to accomplish a purpose," the main essential of good management in the poultry business is a thorough knowledge of the conditions under which poultry do best.

To the average person poultry-keeping appears to be a more or less simple business, but those of practical experience have long realized that the management of poultry in large numbers is one of the most difficult tasks to carry out profitably.

Success in the poultry business really depends upon attention to detail, and there are very many petty details which, though trifling in themselves, are, when taken together, vitally important, for if these little details are not attended to regularly they will in many cases make the difference between profit and loss. It is only by practical experience that one is likely to know or learn of these numerous details, and, because successful poultry-keeping demands the constant attention of so many little details, that practical experience is so essential, and why so many without that necessary experience and the aptitude for constant attention to petty details have failed at the business.

The chief aim of the poultry-keeper should be the production of eggs, and as eggs are produced by so many units of the flock, all of which have to be fed, it requires special supervision and very close attention to every detail of management always to keep enough units of the flock producing in order that sufficient eggs are produced to pay for the flock's keep and give their owner a surplus sufficient to compensate him for his outlay and labour. On all poultry plants much the same daily routine work, such as feeding, watering, cleaning, collecting and packing of eggs, &c., has to be done, yet some have the knack of going about their work in such a methodical manner that these essential routine jobs take up much less time.

It is interesting to watch the successful manager going about his work, and at times surprising to see how much more some are able to achieve than others without much apparent effort. They never seem to get bustled or in a muddle, and their plants are always neat and tidy. This is usually the result of a good practical training, coupled with those gifts of health, energy, and forethought.

Poultry-house Management.

The importance of comfortable, well-ventilated houses and good house-management is not always fully appreciated. The requirements of good housing are plenty of room, fresh air, dryness, and sunlight, and, if there is a lack of any of these, poor production, colds, roup, digestive disorders, and other diseases may be the direct result. Owing to the fact that the normal temperature of a fowl ranges from 106° to 107·5° F., the hens require even more fresh air than is considered adequate for human beings, and, as the air they exhale is saturated with moisture, good ventilation is necessary to remove this from the house as soon as possible, for dampness in poultry-houses is often the result of condensation.

The need for more ventilation is now generally recognized, and up-to-date houses usually are provided with more back ventilation than was the case a few years ago.

Some houses in sheltered positions are provided with as much as 3 in. of an opening right along the back, between the top wall-plate and the roof. However, care must be taken to see that no draughts are created near the perches, and it will be found that less ventilation is required during the cold winter months. It is well, therefore, that arrangements be made so that these openings may be adjusted according to the weather.

The Floors.

The floor of the house should be a few inches higher than the surrounding ground, and proper drainage provided. Concrete floors are recommended. In some localities material for concrete floors is too expensive, and in such cases a good well-rammed clay floor gives good results. At times board floors are used, and if built above the ground so as to allow a circulation of air beneath they prove quite satisfactory.

Litter.

All fowlhouse floors should be covered with 3 in. or 4 in. of good dry straw. This not only provides a necessary means of exercise for the birds, but makes the house warm and comfortable. The litter should receive regular attention, and at least two or three times a week it should be forked up and levelled. As the birds usually face the light when feeding, it will be found that the litter is scratched to the back of the house, and it is advisable to see that it is forked forward regularly.

If the litter remains dry it is an indication that conditions in the house are correct, but if it becomes damp and heavy it should be removed, and the cause, if possible, corrected. Overcrowding, want of ventilation, and low floors are the chief causes of damp litter; in fact, very often a few too many birds in a house will make a great deal of difference between damp and dry litter, especially during the winter months. It is much the wiser plan to cull out a few of the poorer birds than to have damp litter in the houses. Good dry litter soon gets broken up into almost dust, and as this occurs it is a good idea to add an armful of fresh straw about every week, for the birds often eat a good deal of the new straw, especially if they are being fed a concentrated mash, and this weekly addition of a little fresh straw will assist in keeping the flock in the best condition.

If the litter remains dry it will last for months, but if it gets damp and gives off an odour it should be renewed at once. Any material such as vegetable stalks, &c., which are likely to check the birds from scratching should be regularly removed. These little details, such as the regular forking-up and levelling of the litter and the addition of a little fresh material regularly, do not take up a great deal of time, but they all assist in keeping the birds interested and contented, which in turn means better results.

Nests and their Care.

The nests should be arranged in as convenient a way as possible, for they must be visited at least once or twice each of the 365 days during the year. In fact, the time involved in attending to the birds should be reduced where possible, and this can often be done when erecting the houses by placing doors, gates, and nest-boxes in the most convenient places.

The nests should be placed high enough from the ground that all the floor-space may be utilized as a scratching-ground, and it is advisable to see that they are deep enough that other birds cannot see those that are laying. Attention to this detail has a tendency to prevent vent-picking and cannibalism.

Though many hens like to lay in the same nests, it is advisable to provide one nest for each four or five birds, and plenty of clean dry nesting-material should be kept in each nest. Amongst the most popular nesting-materials are straw, straw chaff, shavings, sawdust, especially *Pinus radiata*, and sand, while quite a few poultry-keepers use shell grit. However, whatever material is used an ample supply should be provided, for much loss is occasioned each year from a lack of suitable nests and nesting-material

Grit and Oyster-shell Grit.

A supply of oyster-shell and metal grit should always be within reach of the birds. It is well to provide separate boxes for each material, and so place them in the house that the grit will not get covered over with litter when the birds are scratching By placing these boxes in the houses the grit is protected from the weather, for if grit, and especially oyster-shell grit, is allowed to get wet it is likely to get caked, and in such a state is not liked by the birds Some poultry-keepers fail to appreciate the full value of a constant supply of fresh oyster-shell grit, but most successful poultry-farmers have found that it has paid them to keep this material always before their birds.

Insect Pests.

One of the chief essentials in good poultry management is to keep the house free of insects. When it is remembered that the third generation of one pair of red mite may amount to 120,000, and all this can happen in eight weeks, it is not difficult to realize how a few weeks' neglect could upset one's plans for a whole year.

For this reason every precaution should be taken to keep the perches, nests, and houses free of insects. The perches, nests, and, in fact, everything in the fowlhouse should be movable in order to guard against the ravages of insects. Once each week during the warm weather and once each two or three weeks during the winter months the perches should be painted with a good strong disinfectant. In addition, at least once each year the whole house should be thoroughly cleaned, washed, and disinfected.

Dust Baths.

As the natural way for fowls to keep themselves clean of insects is to dust in the soil, provision should be made for a dust-bath in all houses. A box about 3 ft. square and 1 ft. deep should be sufficient for fifty birds. Dry earth of a sandy nature is suitable for the purpose. It is well to renew this material regularly.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Uniting Colonies.

THE presence of weak hives in the apiary must be avoided as far as possible. During warm autumn days weak colonies rarely escape the attention of robber bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is far the better plan to unite the bees with a stronger colony than to run the risk of unsettling them in the dormant season through the encouragement of wholesale robbing.

Covers.

With the approach of the rainy season it is advisable to make a complete examination of the hive-covers in use. Altogether too little attention is paid to making the covers watertight, and neglect in this direction leads to winter losses. No amount of labour should be spared in saving the bees from exposure and dampness, and by so doing warding off the large annual losses that occur through neglect. There is no excuse for the beekeeper neglecting to protect his bees, and in the long-run a small expenditure on some suitable waterproof roofing-material doubly repays for itself, and is the means of saving colonies that would otherwise be lost. Bees must be kept dry. An examination made of colonies where proper protection is not provided reveals the presence of large quantities of propolis. Usually this is collected to prevent the penetration of external moisture, and it is noticeable that it is gathered freely in the autumn months. Where adequate protection is provided the bees are to a large extent saved the labour of collecting the propolis, and by providing dry roofs the beekeeper is assisting them. In the case of roofs that are cracked, do not attempt to tinker with them, but cover them entirely with some waterproof material. In the long-run metal coverings are the cheapest and the best. Good zinc or galvanized iron makes ideal covering, and lasts for years.

Spare Supers.

Where extracted combs have been placed on the hives for the bees to clean these should be removed and the bees confined to as small a space as possible consistent with the size of the colony. It may be necessary to leave some of the supers on during the winter months, and these can be dealt with in the spring. Do not leave the bees more space than they require, as they desert the lower supers and cluster at the top for warmth.

Mats.

It should be seen that each colony is provided with one or two good mats during the winter months, to keep the bees as warm as possible. Mats should be cut to fit exactly on top of the frames, and may be made from clean sacking or canvas. Sugar-bags or cornsacks make excellent mats and are easily procured. Wood mats are adopted by some beekeepers, and, if desired, may be secured at a moderate cost from dealers in beekeeping material. In districts where the bees do not bring in a great deal of propolis wood mats are effectual. On no account use calico mats, as these afford practically no warmth.

Weeds.

The hives should be kept clear of all weeds, so that the flying bees may have free access to the entrances. Many bees are lost by striking growing obstacles on returning to the hives. For the next few months, when the air is charged with moisture, plenty of air and as much sunlight as possible should penetrate beneath the bottom boards. In damp situations place the hives sufficiently high from the ground to avoid the dampness. Old bricks or concrete blocks make good supports for the bottom-boards Make sure that the hives have sufficient cant towards the front before the winter rains set in. The presence of much moisture on the bottom-boards is the means of loss to the beekeeper, and, in addition, causes the hives to become sour and foul-smelling.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

The Planting Season.

THE months of May to September inclusive are known as "the planting season"—the period during which hard-wooded plants may be set out to best advantage: hedge-plants, shelter-belts, fruit-trees, bushes, and ornamental shrubs. Where the requirements have been carefully studied and planned and the land thoroughly prepared, the work is best done without delay when the ground is free from frost and not too wet. Considerable root-growth is made during the winter, which greatly facilitates establishment. Only in cold exposed conditions is there any advantage in delaying the planting of less hardy plants until the end of the planting-season.

It is best to take delivery of plants of this class so soon as they are ready, and heel them in in a piece of friable ground. They will then be quite secure for the whole of the planting season, if necessary, and may be planted out as weather conditions and other circumstances permit.

Advice on planting is often somewhat laboured, but if the plants are suited to the conditions of soil and climate and the ground has been prepared as advised it is only necessary to observe a few precautions. Straggling and damaged roots should be pruned back, and the plant set in a hole sufficiently big to accommodate the roots without crowding and of a depth which will allow the plant to be set at the same level as in the nursery. In filling, the soil should be broken fine and distributed evenly, and when the roots are covered it should be trodden thoroughly firm, and the filling then completed Loose planting is the commonest and most serious fault. Plants with a long stem, such as standard roses, &c., require staking. For these a hardwood stake of suitable length should be driven when the hole is opened ; the plant is then firmly planted beside it and made secure by tying it to the stake with strong tarred string. A piece of canvas or other material round the stem of the tree under the tie will prevent it from injuring the bark.

Plants which have had their roots considerably shortened when lifting in the nursery will require to be pruned. This operation will require careful consideration—more than it usually receives. Those which make young growth subject to damage by frost, such as roses, are pruned only lightly when planting, the pruning being completed just before, or shortly after, growth commences in the spring—at the later period in the colder districts. Shrubs having more than one stem, or which branch low down, should have the branches thinned to three or four well-distributed growths so that crowding will not take place as they get older. They should be removed completely, close up to the point of origin, cutting them off flush. The remaining growths should then be shortened, cutting just beyond a good bud pointing in an outward direction. The plant will then make well-spaced bushy growth. Plants which it is desired to grow on a main central stem, pyramid fashion, should have any vigorous growth likely to compete with the central leader removed completely. Many specimens that are otherwise admirable have this double leader, which is not only disfiguring by spoiling the balance of the tree but frequently causes serious injury. The remaining branches may then be thinned out where there is any sign of crowding, and the leader and branches left should then be shortened moderately. By careful training in this manner young plants not only make vigorous growth but also shapely trees, which will best attain the main object, whether it be shelter or any other purpose. Plants with fine roots, such as heaths, rhododendrons, and most conifers, require little or no pruning when planting out.

To enable them to make satisfactory growth, most plants require light and air, as well as the soil and water in which they are planted. For this reason grass and weeds should be suppressed when they make their appearance in the vicinity of young trees. Clean culture is most desirable, at least for a few years until the plants are thoroughly established and cease to be in danger of being overgrown by such wild growth. In the case of hedge-plants such growth should never be allowed to attain any considerable height close to the base of the hedge, or much of the foliage there will be destroyed; this will cause great disfigurement as well as reduce the efficiency of the hedge. It is a disfigurement which it is very difficult to adjust. In the case of plantation-trees, spot-planted in grass, the grass should be mown at least once a year, about the month of December before it seeds; it can then be allowed to lie as a mulch, where it quickly decays, and among other useful purposes assists in retaining moisture, especially during the summer months, when young plants are inclined to suffer from a shortage.

Breaking in Grass Land for Cropping.

Land suitable for intensive cropping is a good deep loam on a well-drained subsoil; such soil usually carries a heavy turf, which is best broken in with some care, especially when infested with couch-grass or any other bad weed. In such extreme cases cultivation should be commenced in summer, when the land should be fallowed and cleaned during the dry weather, as has been previously recommended. In an opposite extreme case where the turf is thin and free from serious weeds, ploughing and subsoiling may proceed in the usual way; but where the turf is heavier it usually is best to skim-plough now, and some weeks later when the grass is dead cross-plough, burying the turf deeply, and at the same time using a subsoiling attachment, or a second plough, to break up the bottom of the furrow.

On a new site, water-supply, drainage, and wind-shelter will each require consideration. The difficulties which arise are very frequently due to inadequate attention being given to one or the other of these fundamental requirements. Land suitable for early crops—that is, land with rather sharp drainage and consistently warm temperatures—is most likely to require a well-arranged irrigation system. Fortunately, in most cases of this kind artesian water is easily available, and sprinkler irrigation can be arranged which uses the water with economy and best effect. Apparatus of this class has been much improved during the last few years; sprinklers with wide coverage, even distribution, and instantaneous couplings, for sections where movable piping is used, are now available. Drainage is of greatest importance where the land is heavy, especially where water is received from adjacent higher ground. During the busy periods in autumn and spring it is difficult to " catch " this land in suitable condition for working unless ample drainage is provided. Where the frequent cultivation necessary to intensive cropping has to be done, drainage improvement is essential. On new sites shelter from prevailing winds is often deficient for horticultural crops; in most localities an ample provision of intersecting hedges is required. These should be planted now and given all the attention due to their importance.

Vegetable Crops.

The growth on asparagus crops should now be mown, raked, and burnt; the land should be lightly disked, and a low ridge should be thrown up over the stubble to rot it. Special attention should be given to land being prepared for planting out permanent crops such as asparagus and rhubarb. It should be clean, rich, and deeply worked; a good dressing of kainit for the asparagus and superphosphate for the rhubarb should be included.

When the foliage has died down on rhubarb that is to be replanted, spare roots may be lifted and forced in a dark shed maintained at a temperature of 55° F to 65° F. Place the roots close together with a little light soil between and maintain a humid atmosphere by means of tepid water.

In frost-free localities peas and potatoes are planted now for harvesting in early spring. For this purpose a variety of main-crop pea is chosen, a good strain of Stratagem is popular.

Small and Sundry Fruits, &c.

The unusually high price of shelled sweet almonds at the present time has drawn attention to the production of these and other nuts. From the little experience we have had of almond-growing in the Dominion the indications are that they thrive best in the drier districts where late spring frosts are not severe. Isolated trees are usually barren, as they are generally self-sterile, and to obtain a crop at least two varieties must be planted. The soft-shell varieties are preferable, such as I.X L., Ne Plus Ultra, and Hatch's Nonpareil. These are also suitable for cross-pollination, which will be most effective if bees are kept in the vicinity. An average crop is 5 lb. or 6 lb. of nuts per tree; but twice that weight may be obtained from the above-mentioned varieties under good conditions. The kernels weigh rather more than half the weight of the nuts. Bordeaux sprays in spring and autumn are required to control shot-hole and other fungi. A good soil that is light and well drained suits them best.

Sweet chestnuts (*Castanea vesca*, syn. *Castanea sativa*) are from the mountain forests of Southern Europe and Western Asia. They are handsome deciduous trees with useful timber. Baked or boiled the nuts make a wholesome dish, and are usually popular where they are plentiful. There is ample evidence here that the trees will crop well on good warm hilly country. A group of these trees looks well and provides useful shade, as well as a crop of nuts. Like other nuts, when properly cured, they have good keeping-qualities and may be used at any season.

Filberts, hazels, and cob-nuts are popular names given to varieties of *Corylus colurna* and *C. avellana*. Our supplies have chiefly come from Spain, where these trees are grown extensively, especially in the Province of Tarragona. The most suitable soils there are said to be light, cool, and deep, well aerated, and with a fair supply of moisture. Planting-distances there are 8 metres between rows, and 4 to 5 metres between trees in the row, say, 26 ft between rows and 13 ft. between trees. In cool districts in the Dominion there a few groves planted, and they are cropping well. There appears to be no reason why they should not be extended. When planted in rich, moist soil the trees run to wood and are not profitable. Trees grown with an open centre, on a light well-drained loam, and the suckers suppressed, crop best. Fertilization of the "flowers" is by wind-blown pollen from catkins. For heavy cropping the question of pollination demands careful consideration, but until further variety tests have been carried out here mixed varieties should be planted. An average yield generally is about 1,000 lb. of nuts per acre.

Walnut-culture has been somewhat checked by the prevalence of bacterial blight, but trees vary widely in their susceptibility to this disease. The trouble also is less prevalent in the drier districts.

Selected trees planted in groups, or as single shade trees, or as an avenue, will often serve a useful purpose in addition to supplying a crop of nuts. They should be planted in good well-drained alluvial land in a district with a comparatively low rainfall.

The Homestead Garden.

The planting-season provides the necessary opportunity for planting up shelter-belts and shrubberies in the new garden. Distances between shrubs and trees are usually 3 ft. to 6 ft. or 10 ft., according to the adult size of the subject or the purpose in view. On the windward side a shrubbery at maturity should present to the eye a comparatively close wall of foliage of various shades and shapes; inside are taller trees with an undergrowth of shade-loving shrubs and ferns; on the leeward margin the choicer shrubs and trees are placed, often in rather more open order, the more attractive features being set out in comparatively large groups. While the plants are small and of a similar size, planting should be done with the greatest care to obtain the best effect, for as the plants mature and reveal their character any defects in arrangement will be revealed. The art is best acquired by studying the native bush and public and private gardens and plantations in the vicinity, and noting the results of the various arrangements under the local conditions of soil and climate.

The established garden also usually receives great benefit from some consideration during the planting-season, for, as in the natural bush, there is no finality to the operations of sowing and reaping. With shade and shelter established, many climbers, ferns, palms, and shade-loving shrubs will find a congenial environment and grow away quickly with best results if planted now. And, as ripe pine and gum timber is removed for use, the vacant areas should be replanted where second growth is not expected. Not a garden has been planted but what improvement may now be made as a result of new experience which has been gained. In mild, moist western districts where rhododendron, azalea, camellia, hibiscus, hydrangea, palms, and tree-ferns flourish these should more usually provide the materials for some of the more outstanding features in the gardens. Most of the kinds of plants mentioned have a wide variety that provides for almost any effect which may be desired. In the drier atmosphere of eastern districts the rose, carnation, wattle, bignonia, bougainvillea, syringa, tamrix, magnolia, oleander, banksia, phœnix, and fan-palms are among those plants which readily make a good display under the conditions there: also most bulbs of African origin, and tubers and bulbs, such as irises, anemones, &c., from the Near East, if comparatively dry sites are chosen. The present season presents an opportunity of extending the more desirable features in garden-planting in the place of those less suitable.

In new gardens where the preparation of the land has not reached the planting-stage, the work should be continued when the land is sufficiently dry, with a view to sowing down lawns about the month of August and completing the planting of hard-wooded subjects by the end of September—especially in the drier localities.

—*W. C. Hyde, Horticulturist, Wellington.*

Parasitic disease is responsible for considerable loss in young cattle. Many calves die or have their constitutions undermined by the action of internal parasites. In combating the trouble, the importance of the provision of extra nutritious feed in assisting the young animal to overcome the effects of the parasites cannot be overestimated. In this respect chaff, oats, and good hay will do far more good than drenching with worm medicine.—*Annual Report, Director, Live-stock Division.*

SEED-WHEAT CERTIFICATION.

FOLLOWING is a list of growers whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed, and the sacks suitably sealed and tagged. (A previous list, to which those interested are referred, appeared in the March *Journal*) :—

Variety.	Grower.	Acreage.
Cross 7	Allan, A. T., Scargill	64
	Amyes, C. G., Fernside, Rangiora R.D.	14
	Brown, I., Grovetown, Blenheim	7
	Calder Bros., Cave —	
	Line A	18
	Line B	9
	Canterbury Seed Co., Leeston	10
	Davies Bros., Waiau	25
	Gardiner Bros., Waitohi, Temuka	35
	Gartery, F. W., Springbank, Rangiora R.D.	28
	Hall, K. W. J., Hororata	42
	Jones, C. H., Winchmore R.D.	7
	Kennedy, T., Greenstreet, Ashburton	10
	Lowe, G. J., Coldstream, Rangiora R.D.	11
	Lowery, W. C., Winchmore R.D.	17
	McCaw, J. and F., Hakataramea	20
	McLachlan, W. H., Rangitumau, Masterton	8
	Mulligan, W. H., Maronan, Ashburton	8
	Nutt, H. A., Motukarara —	
	Line A	16
	Line B	8
	Turner, C. W., Halkett	23
	Waddell, R., Chertsey	10
Dreadnought	Canterbury Seed Co., Leeston	
	Line A	12
	Line B	10
	Coughlan, M., Kingsdown, Timaru	10
	Dempsey, J., Hook —	
	Line A	35
	Line C	20
	Saunders, F. L., Studholme	6
	Stewart, J. L., Hook, Waimate	10
	Wilkinson, T., Section 3, Cormacks R.D.	10
	Williams, J. C., Section 4, Kokoamo R.D.	10
Hunter's II	Calder Bros., Cave	13
	Campbell, D. A., care of P. G. Ellis and Co., Rangiora	7
	Evans, H., Upper Plain, Masterton	12
	Muirhead, J. H., Lagmor, Ashburton	40
	Reeve, E. J., Coups Road, Kaiapoi	16
	Royds, R. S., 412 Burnside Road, Fendalton	4
Jumbuck	Canterbury Seed Co., Leeston	6
	Steven, G. H., Rosewill, Timaru	7
Solid Straw Tuscan	Hille, W. G., West Melton	26
	Johnston, R. H., Dunsandel	100
	Kinnimont, J., Section 7, Cormacks R.D.	10
	McCarthy, E., Prebbleton	17
	Miller, D., Leeston	10
	Muirhead, J. H., Laghmor, Ashburton	31
	Rathgen, Mrs. I. E., Leeston	14

—*Fields Division.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WILT IN TOMATOES, VERBENA, AND LARKSPUR.

C. T. B., Timaru :—

Has the growing of blue lupin caused verticillium wilt in my tomatoes this season ?

Last year I sowed blue lupins in February for green manure ; they grew to about 12 in. and then were dug in for green manure, on the same ground. Verbena and larkspur were planted, and long before maturity fully 50 per cent. of the plants withered and died Tomatoes were similarly affected where planted in the same ground. Only one survived.

The Horticulture Division :—

There is no record or proof of blue lupin being a host of *V. albo-atrum* The practice of planting the types of plants mentioned by you on top of recently dug-in sappy lupin is to be condemned, as all the conditions are suitable for fungous attack. Without specimens of affected plants it is impossible to determine the cause of the " wilt " condition, which in your case is probably *Sclerotinia*, but not necessarily the same organism attacking both the larkspurs, &c., and the tomatoes.

ACTION OF BLUESTONE SOLUTION AS DRENCH.

J. B. V., Te Mata :—

I understand that when drenching sheep with bluestone or a combination with bluestone, the bluestone closes up a certain canal or passage and thus allows the solution to go straight to the fourth stomach. If so, how long a time elapses after the first part of the dose (say, ¼ oz.) enters the mouth before that passage is affected and closed.

The Live-stock Division :—

It has been found by Dr. Clunies Ross in Sydney that the action of the bluestone solution commences in the mouth of the animal. It is the chemical reflex action of the copper on the mucous membrane of the mouth which causes the closure of the oesophageal groove Therefore, any fluid swallowed by the animal should all go into the fourth stomach. Dr. Ross's experiments show that this is the case. It is also possible first of all to give a bluestone solution alone and then follow up within fifteen seconds with a dose of any other medicine which you wish to reach the fourth stomach directly.

WIREWORMS IN POTATOES.

Subscriber, Totara Flat :—

Is there any remedy for the control of wireworms in potatoes, and are certain varieties more susceptible to their ravages than others ?

The Fields Division :—

Beyond thorough cultivation, there is no satisfactory means of dealing with wireworms. Practically all pasture carries a population of wireworms, and when the pasture is broken up and the land sown in such crops as potatoes the wireworms may attack and do considerable damage to the tubers in the first season, but infestation diminishes considerably the longer the land is under cultivation. Soil fumigation may at times do a little good, and the use of calcium cyanide worked into the ground during cultivation, at the rate of 200 lb. to the acre, has been said to have a good effect. The cyanide should be applied not later than fourteen days before a crop is sown. This treatment is only practicable, however, for comparatively small areas. It is not considered that certain varieties of potatoes are more susceptible than others to the ravages of this pest.

WEATHER RECORDS: MARCH, 1937.

Dominion Meteorological Office.

NOTES FOR MARCH.

THE cold conditions of the previous months were continued through the first half of March, but the second half was warm. Though the rainfall was below normal in most places, cloudy and humid conditions prevailed, and few places felt any shortage. Stock are reported to be in good condition, and there is abundance of pasture. Lambs are fattening, on the whole, rather better than earlier in the season, though the feed is generally still rather soft. Harvesting was done in difficult circumstances, and some of the wheat was again damp. The lack of dry, sunny weather has adversely affected the production of grass-seed and some other crops. White butterflies were rather numerous and destructive.

Rainfall.—In the North Island, North Auckland, the Northern Waikato, and the Bay of Plenty areas had considerably more than the average rainfall, but over the remainder only about half of it was recorded. In the South Island there was an excess in North Canterbury, Southern Otago, and Southland, and at a few places in Westland, but a defect elsewhere. South Canterbury, especially, had much less than the average.

Temperature.—Mean temperatures differed little from the normal for March, the warm weather in the latter half of the month compensating for the cold of the first half. Between the 10th and the 13th some rather sharp frosts were recorded, and some damage was done to tender plants. Sunday, the 28th, was, at many places, the warmest day of the season, over 80° being recorded at some North Island stations.

Sunshine.—Slightly more than the average amount of bright sunshine was recorded in the far North, at Auckland, and the far South, at Invercargill, but over most of the country there was a deficit of about twenty to forty hours. Seldom, if ever, indeed, has so sunless a March been experienced.

Pressure Systems.—The only very pronounced storm occurring in the New Zealand area during the month was that which developed as a tropical cyclone in the New Hebrides region at the end of the third week. It was then rather violent and extensive, and heavy rain, accompanied by strong gales, was experienced at Norfolk Island. The most usual procedure is for these storms to begin to take a more easterly course from this stage onward. In this particular case, however, a rather deep westerly depression developed at the critical time over south-eastern Australia, and the cyclone was drawn into its circulation. It continued to move southwards, keeping about 400 miles off the New Zealand coast, and on the 27th began to fill up. North-easterly gales had been caused by it in the northern part of the Auckland Peninsula, but no strong winds elsewhere. On the 28th, merging with the oncoming westerly depression, it reinforced the latter, causing a stormy day with north-westerly gales in many places about and south of Cook Strait. On the next day it had disappeared. During its rather varied history it brought heavy rain to most of the country. Rain during the first four days was heavy in many places.

From the 8th to the 13th south-westerly winds and cold, showery weather prevailed over the Dominion. It was during this period that frosts were experienced, and snowfalls occurred on the mountains. These were unusually heavy for the time of year, particularly on Mount Egmont.

From the 19th to the 22nd some heavy rains fell in the south-western and southern parts of the South Island.

RAINFALLS FOR MARCH, 1937, AT REPRESENTATIVE STATIONS

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Fall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches		Inches.	Inches.	Inches.	Inches.
Kaitaia	2·24	13	0·96	3·10	14·71	10·54
Russell	6·21	10	2·63	4·09	24·15	12·42
Whangarei	6·05	14	3·11	4·45	18·34	12·25
Auckland	3·52	14	0·97	3·27	8·99	9·81
Hamilton	2·90	12	1·19	3·76	10·00	10·24
Rotorua	5·15	14	3·06	3·48	13·65	11·44
Kawhia	..	..	..	4·21	..	9·83
New Plymouth ..	1·82	13	0·31	3·68	17·30	11·80
Riversdale, Inglewood ..	4·15	16	1·55	7·04	29·13	20·58
Whangamomona ..	4·18	9	1·47	4·98	20·20	14·45
Hawera	1·68	12	0·43	3·01	11·88	8·92
Tairua	5·81	12	2·58	5·21	13·05	13·55
Tauranga	5·94	14	2·61	3·92	12·52	11·73
Maraehako Station, Opotiki	6·08	12	1·35	3·96	17·66	11·69
Gisborne	2·97	8	2·28	4·42	8·85	10·60
Taupo	2·58	12	1·86	3·14	8·48	9·25
Napier	1·21	9	0·78	2·66	6·62	7·62
Hastings	0·86	7	0·49	2·76	3·98	6·94
Whakarara Station ..	1·47	7	0·34	..	8·67	..
Taihape	1·38	12	0·20	2·60	7·94	8·19
Masterton	1·84	9	0·66	2·75	8·74	8·09
Patea	1·83	12	0·34	3·35	12·73	9·34
Wanganui	1·67	10	0·50	2·47	10·13	7·72
Foxton	1·15	10	0·35	1·98	7·17	6·19
Wellington	2·22	13	0·83	3·20	9·62	8·84
			South Island			
Westport	6·32	17	1·17	7·50	25·97	21·05
Greymouth	9·18	20	1·80	8·80	35·48	24·18
Hokitika	7·74	20	1·62	9·51	35·94	26·83
Ross	8·35	16	1·41	10·73	43·00	32·03
Arthur's Pass ..	6·64	8	3·11	13·19	45·75	37·21
Okuru, South Westland	16·03	10	4·30	14·15	40·74	36·40
Collingwood	4·68	11	1·86	5·81	25·01	17·08
Nelson	2·19	10	1·01	2·92	9·71	8·45
Spring Creek, Blenheim	0·82	9	0·26	1·98	7·85	6·38
Seddon	0·67	7	0·32	2·00	6·36	5·69
Hanmer Springs ..	3·29	12	1·02	3·26	7·96	10·47
Highfield, Waiau ..	1·73	10	0·50	2·84	4·31	8·42
Gore Bay	2·78	11	0·99	2·13	6·34	7·39
Christchurch	1·98	..	0·52	1·84	6·25	5·73
Timaru	1·71	13	0·56	2·16	7·89	6·34
Lambrook Station, Fairlie	1·26	12	0·47	2·34	7·54	6·58
Benmore Station, Clearburn	1·85	13	0·82	2·41	10·08	6·80
Oamaru	1·06	13	0·37	1·78	5·46	5·61
Queenstown	2·19	13	0·67	2·62	9·83	7·46
Clyde	2·03	14	0·66	1·49	6·31	4·40
Dunedin	2·92	19	0·65	2·90	13·38	9·02
Wendon	4·90	16	0·90	2·74	17·36	8·20
Balclutha	3·14	18	0·72	2·31	12·27	6·61
Invercargill	5·41	20	1·56	3·89	15·17	11·07
Puysegur Point ..	8·87	22	1·04	7·97	29·44	21·33
Half-moon Bay ..	7·31	18	2·08	5·37	20·06	14·27

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THE FEEDING OF PIGS.

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ORGANIZING THE FEED-SUPPLY

AMONG those who inquire about the feeding of pigs, the man who is short of feed, either because it is not to be had or because it is too dear to buy, is met most frequently. The man who has abundance of feed, whatever its kind, is seldom inquiring The man who has plenty of feed may have it by chance, but more usually his plenty is the result of his own planning. Organization and planning is not a very pleasant pastime: it is far more necessary with the feed-supply of pigs than it is with that of cattle and sheep, and for this reason pig-keeping is not popular.

Organization with pigs is important, because at least 80 per cent. of the value of a pig is the feed it has eaten, because pigs get very little of their feed from the paddocks—they are mostly hand-fed—because they are fed on relatively concentrated and therefore valuable foodstuffs, and because they have two peak-production periods each year, and so do not fit into the single yearly peak of natural growth in the way that cows, sheep, and other animals do. The questions of cost and distribution of the feed-supply require special consideration.

Where skim-milk is the chief summer feed, the question of value or cost is not important, but the one of distribution is very much so. Some source of winter-feed supply is essential if value is to be obtained from a costless milk-supply It is easy to feed pigs on skim-milk for some one else's profit, if much feed is bought or if insufficient attention is given to a cheap winter-feed supply. Where grain is the chief source of feed-supply the question of distribution does not arise, since grain can be stored till it is wanted, but the question of cost is all-important. Both milk and grain are high-quality feed-supplies: each bears dilution with cheap low-quality feed, and in both cases profits are determined solely by the amounts of cheap feeds that are used. Organization and planning of a feed-supply is therefore of considerable importance.

CHEAP FEED THE BASIS OF PROFIT.

The necessity of cheap feed is not peculiar to New Zealand, but it is the very essence of profit here, because of the relatively low prices of pig meats. Many farmers get from pigs returns as high as 60s. per cow. Some attribute their success to the fact that they produce weaners, others that they produce baconers, others to a thrifty strain of pigs, others to the care they exercise in looking after their pigs, and others to the skilful use of small quantities of grain. A consideration of the circumstances leads one to the conclusion that none of these things is the prime cause of success. They are merely incidentals, and the common factor of all successful pig-feeders is that they have used, along with their milk and grain, cheap, home-grown feed, roots, or pastures in such a quantity that about half the total feed used is grain and milk.

FEED QUANTITIES REQUIRED.

To feed a sow for a year and produce two litters (fourteen pigs) to the weaner stage, feed equivalent to about 3,000 gallons of skim-milk or 1½ tons of grain in required. To feed the sow and litters to the pork stage (90 lb. carcass), 4 tons of grain or its equivalent is required, and to feed a sow and the litters to the bacon stage (140 lb. carcass), 6 tons of grain is required. When weaners are 14s. per head and pork and bacon 5d. per pound, the gross returns for feed used (milk alone, grain alone, or milk and grain) are about £6 12s. per short ton of grain, and about ¾d. per gallon of milk (on the basis of 500 gallons, 31s. per cow). This is a gross theoretical maximum that may be achieved with grain, since grain can be stored until it is required, but is certainly not attainable with milk because of its poor distribution throughout the pig-feeding year. If, now, half the feed-units are replaced by pasture or roots, the costs and returns are somewhat as follows: Using the case of porker-production as an example, 4,000 gallons milk (or 2 tons grain) plus 20 tons of roots give a gross return of 14 pigs × 90 lb. × 5d. per pound = £26 15s.; roots cost, say, 5s. per ton: total, £5. And so the 4,000 gallons of milk (2 tons grain) show a gross return of £21 15s.—*i.e.*, £10 17s. 6d. per ton for grain, or 1·3d. per gallon for skim-milk, or 54s. per cow: Some may consider it unprofitable to produce roots at 5s. per ton. Nevertheless the whole success of pig-production depends on roots at this cheap rate, and it is certain that if the root crop at 5s. per ton is itself unprofitable because of low yield or high production-costs, then roots cannot be used to enhance the profits. Others may object that roots are a dangerous or unsuitable pig-feed, and the answer to that objection is that many use them with success and satisfaction.

KINDS OF CHEAP FEEDS TO GROW.

Roots have been nominated in the above case as the most suitable feed, but no hard and fast rule can be laid down. The only guide as to which is the best source of cheap feed is the yield of feed-units that can be obtained and the cost of obtaining it. The following table gives feed-units per ton and yields per acre.

Table I.—Comparative Values of Different Feedstuffs and Yields per Acre.

Crop.	Yield in Tons per Acre	Pounds Feed-units per Ton.	Pounds Feed-units per Acre.
Parsnips	40	240	9,600
Carrots	40	200	8,000
Swedes	45	160	7,200
Cabbage	30	200	6,000
Chou moellier	20	180	3,600
Kale	15	200	3,000
Rape	9	240	2,160
Mangels	60	150	9,000
Artichokes	12	400	4,800
Potatoes	12	400	4,800
Stock melons	60	130	7,800
Pumpkins	60	180	10,800
Soft turnips	30	100	3,000
Grass	18	260	4,680
Lucerne, green	16	200	3,200
Lucerne hay .. .	5	650	3,250
Silage	12	270	3,240
Grains (short tons)—			
Barley . ..	1	1,440	1,440
Maize	1½	1,640	2,420
Wheat .. .	1	1,400	1,400
Peas	1	1,400	1,400
Oats	1	1,200	1,200
Pollard	..	1,200	..
Bran	..	900	..
Meat-meal	..	1,800	..
Linseed-meal ..	..	1,600	..

In the above table each crop has a yield in tons per acre set out beside it. These cannot be the relative yielding-capacities of these crops in any locality. They are included here for the purpose of calculating the amount of feed-units grown per acre at that yield. It is necessary to take both yield and quality into account in valuing a crop and then to look at the costs of growing that crop in comparison with other crops. In the past too many have grown crops because of convenience or prejudice. While convenience is of some importance, it can be overdone. Artichokes are often grown as a pig-feed because they call for very little expense, and little work in feeding them. A 6-ton crop of artichokes producing 2,400 feed-units per acre for just the cost of the rent, say, 30s. per acre, compares favourably with an 80-ton crop of mangels producing 12,000 feed-units if the mangels cost £8 per acre to produce. The middle course is, however, probably the most useful. Grow small areas of several different crops in place of a larger area of any particular one. Do not grow 2 tons of artichokes when your land could grow 100 tons of mangels per acre.

It has been stated that the ideal amount of these cheap feeds is about half the total feed used, and in quantity this amounts to 2½ tons for every cow milked, say, 1 acre of a good crop for 30 cows plus 10 tons for every ton of grain bought. There is nothing to be gained by trying to use still greater amounts of the cheap feed, because the quality of the whole feed-supply is so reduced by using too much cheap feed that it is impossible to get pigs to thrive on it.

How to use Cheap Feed.

In order to use this specialized cheap feed-supply it is probable that slight departures have to be made from the usual routine of pig-keeping. It is probably convenient to have the winter stores ready to fatten to baconers when the milk first comes in, and weaners from the spring litters ready to use the milk somewhere in November. For pigs that are not being fattened a small allowance of milk, not more than 1 gallon per day, along with as much other feed as they will eat seems to be the general practice. Where these cheap feeds (soft turnips, rape, lucerne, or grass) are likely to taint or discolour carcasses, they must be withdrawn during the last three weeks prior to slaughter. Where milk is not available during winter, meat-meal must be used along with roots, especially with younger pigs and sows.

Amounts of Feed required per Day.

Much has been written about the amounts to be fed to pigs per feed or per day. On most places pigs are users of all the skim-milk, and provided they clean it up each day no one cares whether it is 20 per cent. too much or 10 per cent. too little. Pigs can grow at rates varying from nothing up to 3 lb. per day, and from this it follows that the amount of feed given can vary over a very wide range. All animals are most accommodating in this respect—they can over-eat for a few days and keep quite healthy; they can under-eat for many days and still look satisfactory. Eating 6 lb. of feed per day they may be bloated; eating 2 lb. they may be hungry.

It is possible to state how much feed is required daily only when the weight of the animal, the growth-rate per day, and the kind of feed are also stated. Expressed in feed equivalent in value to barley a young growing animal can eat a maximum of 6 per cent. of his weight each day; a 50 lb. pig can eat 3 lb.; on the other hand, an aged sow can live on a minimum of 1 per cent. of her live-weight—*i.e.*, a sow of 400 lb. weight can live on 4 lb. of feed per day. There is, however, a satisfactory growth-rate at which average pigs grow and keep healthy, and the feed consumed under these conditions amounts to about 4 per cent. of the pig's weight, slightly higher when young, slightly lower when old. The following table sets out the average age in weeks, weight in pounds, growth-rate in pounds per day, and feed consumption in pounds per pig per day. (Feed as pounds of barley-meatmeal mixture, or as gallons of skim-milk.)

Table II.—Daily Rations for Pigs—Rapid Growth

Age (Weeks).	Live-weight (Pounds)	Live-weight Increase per Day (Pounds).	Pounds of Feed daily for		
			Maintenance.	Production.	Total
1	6·0	0·5	Mother's milk sole feed-supply.		
2	9·5	0·5			
3	12·3	0·4			
4	15·8	0·5	..	.	..
5	20·0	0·6	0·90	0·30	1·20
6	24·9	0·7	1·00	0·40	1·40
7	29·8	0·7	1·20	0·46	1·66
8	35·4	0·8	1·25	0·48	1·73
9	41·0	0·8	1·30	0·50	1·80
10	47·3	0·9	1·40	0·54	1·94
11	53·6	0·9	1·60	0·55	2·15
12	60·6	1·0	2·10	0·62	2·72
13	67·6	1·0	2·30	0·63	2·93
14	75·3	1·1	2·50	0·72	3·22
15	83·0	1·1	2·70	0·80	3·50
16	90·7	1·1	2·80	0·90	3·70
17	99·1	1·2	2·90	1·14	4·04
18	107·5	1·2	3·00	1·23	4·23
19	115·9	1·2	3·05	1·32	4·37
20	124·3	1·2	3·15	1·38	4·53
21 .. .	133·4	1·3	3·22	1·56	4·78
22	142·5	1·3	3·30	1·69	4·99
23	151·6	1·3	3·39	1·79	5·18
24	160·7	1·3	3·44	1·87	5·31
25	170·5	1·4	3·50	2·12	5·62
26	180·3	1·4	3·58	2·27	5·85
27	190·1	1·4	3·64	2·37	6·01
28 . ..	199·9	1·4	3·70	2·42	6·12

These amounts have been calculated from first principles as laid down in Wood's Animal Nutrition, p. 163. The calculated amounts agree closely with those used in the most efficient feeding trials where healthy pigs have been fed in suitable sties and under suitable weather conditions

In general it is most profitable to feed pigs in such a manner that they will grow as fast as they can. It has been found, however, that where pigs fatten and grow at the same time their carcass tends to be short and to carry too much back fat. Consequently one has to strike a happy medium between efficient feed-conversion and suitable carcass-quality. Pigs that grow at the rate of about 1¼ lb. per day over the last stages of bacon-weights are usually not too fat on the back, and their efficiency as converters of feed is satisfactory.

FEEDING WITH LIMITED QUANTITIES OF SKIM-MILK.

The rates of growth and the amounts of feed set out in the last table are just about the maxima that average pigs are capable of. There are times when the feed-supply is limited and the growth-rate correspondingly small. It often happens that the growth-rate is so slow that interest in the pigs is lost and they become neglected. That's the dangerous time, everything seems to go wrong.

In the following table there are set out the rates of growth associated with a long store period, ½ lb. per day from fourteen weeks to twenty-eight weeks, about ¾ lb. per day for a further three months, until a weight of 170 lb. is attained, and then about 30 lb. in twenty days of finishing off.

Table III.—Daily Rations for Pigs—Slow Growth.

Age (Weeks).	Live-weight (Pounds).	Live-weight Increase (per Day).	Pounds of Feed daily for		
			Maintenance.	Production.	Total.
1	6·0	0·5	Mother's milk only.		
2	9·5	0·5			
3	12·3	0·4			
4	15·8	0·5	..	..	..
5	20·0	0·6	0·90	0·30	1·20
6	24·9	0·7	1·00	0·40	1·40
7	29·8	0·7	1·20	0·46	1·66
8	35·4	0·8	1·25	0·48	1·73
9	40·3	0·7	1·28	0·42	1·70
10	44·5	0·6	1·35	0·36	1·71
11	48·7	0·6	1·45	0·36	1·81
12	52·9	0·6	1·56	0·36	1·92
13	57·1	0·6	1·80	0·36	2·16
14	61·3	0·6	2·10	0·36	2·46
15	64·8	0·5	2·10	0·34	2·44
16	68·3	0·5	2·30	0·35	2·65
17	71·8	0·5	2·39	0·35	2·74
18	75·3	0·5	2·48	0·35	2·83
19	78·8	0·5	2·57	0·35	2·92
20	82·3	0·5	2·67	0·35	3·02
21	85·8	0·5	2·75	0·40	3·15
22	89·3	0·5	2·79	0·40	3·19
23	92·8	0·5	2·82	0·45	3·27
24	96·3	0·5	2·89	0·45	3·34
25	99·8	0·5	2·96	0·48	3·44
26	103·3	0·5	2·98	0·50	3·48
27	106·8	0·5	3·00	8·50	3·50
28	110·3	0·5	3·02	0·55	3·57
29	115·0	0·7	3·05	0·77	3·82
30	120·0	0·7	3·10	0·77	3·87
31	125·0	0·7	3·15	0·80	3·95
32	130·0	0·7	3·18	0·82	4·00
33	135·0	0·7	3·22	0·84	4·06
34	140·0	0·7	3·28	0·88	4·16
35	145·0	0·7	3·30	0·94	4·24
36	150·0	0·7	3·36	0·95	4·31
37	155·0	0·7	3·40	0·96	4·36
38	160·0	0·7	3·44	0·98	4·42
39	165·0	0·7	3·47	1·00	4·47
40	170·0	0·7	3·50	1·02	4·52
41	177·0	1·0	3·55	1·65	5·20
42	187·0	1·5	3·60	2·47	6·07
43	200·0	1·8	3·70	3·15	6·85

This rate of growth can be obtained by using the pounds of grain or gallons of milk stated from weaning till fourteen weeks old, gradually changing then to ½ lb. of meat-meal or 1 gallon of milk plus all the cheap feed the pigs will eat—*e.g.*, grass, roots, potatoes, artichokes, marrows, &c.

When the pigs are 70 lb. alive they will have to eat ½ lb. of meat-meal and 17 lb. of roots per day in order to get 2¾ lb. of feed. At 110 lb. alive they will want ½ lb. of meat-meal and 24 lb. of roots. At 170 lb., ½ lb. meat-meal and 32 lb. of roots. During the last three weeks the use of roots is discontinued, and the pigs eat from 5¼ lb. up to more than 6¾ lb. of grain or gallons of milk per day.

ECONOMY OF FEED-CONVERSION.

Where the pigs grow rapidly the total feed-consumption is about 580 lb. per pig. It is all high-quality feed. Where the pigs grow slowly the total feed-consumption is about 865 lb. per pig. Of this, only 325 lb. is high-quality feed. The remaining 540 lb. is obtained from, say, 2 tons of mangels. All sorts of further calculations can be done by those who have followed so far, and the results all point to the advantages of using these cheap feeds.

At finishing, these pigs are about forty-three weeks old, and, if this takes place in the flush of the milk season, in, say, November and December, the pigs should have been farrowed in January and February. These fattening baconers should just be finished when the next litter is just out of its babyhood, and it could be taken rapidly to bacon at about six to seven months old

BALANCED FEEDS.

In every country of the world the first approach that the scientist makes to the question of feeding is by way of the composition of the feedstuffs. The amounts of protein, fat, and carbohydrate determine accurately the value of a feed, and a knowledge of them usually accounts for the observed properties of the feed. The man who uses the feed, however, can make little use of the analysis, nor can he take any advantage of the advice so frequently offered that he must use balanced feeds. Not only has the animal a tolerance for a very wide range of quantities, it has an even greater one for a range of qualities. After a short time it can adjust itself to four or even six times the amount of protein that is ideal, and can get along with about half the quantity it should require. Similarly, with minerals, it can live and be healthy with just the minerals found in grain or it can consume added minerals at the rate of ounces per week. This tolerance is most remarkable while the pig is "idling" and while it has a few reserves stored away in its body. As soon as these reserves become depleted or when the pig is fed, liberally enough to grow, then trouble arises. This takes the form of any of the common ailments from lameness and rickets to constipation, worm-infection, to pleurisy. Unsuitable feed that lowers the tone of the animal system is the opening through which most of the ailments of pigs find entry. Those whose pigs grow satisfactorily but still are subject to certain ailments may dissent from the viewpoint stated above. It is quite possible to get rapid growth on unsuitable feed, but it need not be healthy growth. With unsuitable feeds the more rapid the growth the more unhealthy the animal is—a fact that is made use of in the production of experimental rickets. Even although it is "growth for feed used" that makes a feed-supply valuable, growth and good health are a better combination than growth and ill health. The signs of health that are unmistakable are a sleek coat, a shining skin, a bright eye, energetic action, and normal excreta. A feed-supply that leaves pigs wanting in any of these, in spite of the fact that the pigs are growing rapidly, is unbalanced, and would be improved by the addition of the missing ingredient.

THE MISSING INGREDIENT.

Most people can tell at a glance if their pigs are in normal health, but because of the interplay of many factors such as age, rate of growth, amount of sunlight, presence or absence of parasites, and all the variables that influence a pig's health it is often difficult to recommend with any measure of assurance treatment that will improve things. Although the value of minerals, condiments, and vitamins is widely recognized, it is most remarkable how many healthy pigs there are in the country that get no added minerals or condiments, and live, sometimes on skim-milk, sometimes on butter-milk, sometimes on offal, and sometimes on a wide variety of home-grown feeds plus milk. The common thread that runs all through these different places is the care of the owner. He feeds regularly, he feeds just as much as the pigs clean up. His pigs are always looking for more, but never really hungry. He is a careful observer. Any pigs that require attention get it promptly. He is careful to have just the right number of pigs that will use his feed-supply at every time of the year, and generally he pays attention to all the details that require attention. As a result one can say with a good deal of conviction, and with no desire to be clever or offensive, that the best supplement than can be used with any feed-supply, no matter what its origin, is understanding and care on the part of the owner. It is not every one's good fortune that he can take care; or, put otherwise, things go wrong with some in spite of the best of care. In such cases it becomes necessary to find something than can be added to the ration in order to keep pigs healthy with limited care.

MINERALS OR VITAMINS OR ?

One of the most striking happenings associated with pig-feeding is the wonderfully sleek appearance of pigs that are being fed on lucerne. Whatever their age or state, after weaning, pigs that receive lucerne, green or as chaffed hay, are always sleek and healthy, provided, of course, that lucerne is not their sole feed. Whether its value lies in the minerals contained in it, or in the vitamins, or the protein value, we will never know, because of the difficulty of separating these things, but the fact remains that lucerne puts a shine on the coat not excelled by any other class of feedstuff. Next to lucerne, ordinary green pasture, provided it is young, keeps pigs quite healthy, and although not so universally excellent as lucerne nevertheless it is quite valuable. Next, the oil-bearing feeds such as linseed cake, oats, and meat-meal fed in small amounts make pigs healthy-looking, and here again it is impossible to fasten with any assurance on the ingredient that is most useful. Pigs fed on offal—boiled meat scrap—are always remarkably healthy, and one is almost forced to the conclusion that animal fat is most beneficial. Finally there are the well-known benefits that so many have obtained from using minerals such as wood ashes, charcoal, slack coal, licks of various kinds containing salt or sulphur or iron or iodine or lime or phosphates. It seems impossible to make any authoritative statement on the question of minerals. The question was investigated by Sheehy in Northern Ireland some time ago, and over a period of five years after trying every kind of mineral-mixture he found that salt and limestone, 1 part to 4 parts, used at the rate of 3 per cent. of the dry-weight of feed was the most useful mineral. A pig of 100 lb. weight, eating 4 lb. of feed or its equivalent, would want daily about 1½ oz. of minerals. A useful way to feed minerals is to have the supply handy, and with a known measure, such as a baking-soda or other tin, put the calculated amount in the trough daily. It sounds very complicated, but it can be done quite easily if it is worth while.

ATTENTION TO DETAIL MORE IMPORTANT THAN ANYTHING ELSE.

From what has been said it is apparent that in spite of the supposed advisability of knowing how much a pig should receive per day and how much protein, fat, carbohydrate, and minerals there is in his ration it is seldom that the good results obtained by a feeder can be ascribed to this knowledge. More usually success is associated with attention to some or all of the following rules :—

(1) Feed regularly as to time and amount

(2) Feed just as much as the pigs will clean up.

(3) Do not leave stale food in troughs. Movable troughs can be profitably turned over ; fixed ones could profitably have a hinged lid that keeps the trough clean.

(4) If pigs fail to thrive after attention has been given to the above rules, then the quality of the feed-supply is at fault or the pigs are unhealthy. It always pays to correct the trouble, and the improvement of the feed-supply is either a matter of adding green grass to the ration or ½ lb. of any grain or ¼ lb. to ½ lb. of meat-meal ; or perhaps 1 oz. of lime and salt mixture. Experience usually decides which of these gives results.

QUALITY USUALLY GOOD.

It is rarely that the feed-supply itself is of such a quality that it can be blamed for poor pigs. On any place where pigs are kept there may be a dozen healthy pigs for every sick one. It is a fair assumption that the sick one is the result of some chill or setback such as human beings experience from time to time, and that the dozen healthy ones are a striking advertisement for the excellent quality of the feed-supply. This is generally correct for those months of the year when skim-milk. is the chief source of feed-supply. When skim-milk is in short supply it often happens that most of the pigs fade visibly, either because they have too little feed or else because the quality of their feed is below standard. The feeds in use are usually home-grown, varying from grass through any kind of fodder crop to roots of all descriptions, plus at times a little grain. There is one addition that can be made to every feed-supply, skim-milk included, that will always bring feed-quality up to a standard that enables pigs to thrive—*i.e.*, meat-meal.

USE OF MEAT-MEAL.

Meat-meal added at the rate of ¼ lb. to ½ lb. per pig per day improves every known feed for pigs in proportion to its unsuitability. Added to raw potatoes or roots of any description, feeds on which young pigs go back in condition, even to the stage of dying, and on which grown pigs just " hold their own," meat-meal improves the feeding-value from about 3s. per ton up to 30s. per ton, after paying for the meat-meal used.

Grass fed to pigs returned about 12s. per acre per month without meat-meal, with meat-meal the value of grass was 40s. per acre per month, after paying for the meat-meal. These are striking improvements, so striking that they almost have to be seen first before they can be believed. One does not appreciate the value of meat-meal unless the results of it have been seen, and there is certainly no feed used in small amounts that does give such striking results, especially with feeds that are not by themselves pig-feeds. With milk or grain the benefits from using meat-meal are still noticeable, but not in such a definite way. As a general rule, meat-meal at the rate of ½ lb. per day or skim-milk at the rate of 1 gallon per day should be used as a foundation feed-supply for all pigs after weaning. From weaning until pigs are 70 lb. live-weight—*i.e.*, at twelve to fourteen weeks old—they are still babies, and should receive as a minimum 2 gallons of milk per day, or ½ lb. of meat-meal and 1½ lb. of grain. In addition they may be fed further milk or grain, as much as they will eat, or else they should be allowed access to roots or pasture to " pick up " as much as they want. This 2 gallons or 2 lb. of feed supplies all their wants till they are about 50 lb. weight, but only enough for limited growth after that weight. Unless it is supplemented with other feed, growth will be slow after 50 lb. is reached. If the pigs are being taken on to porkers, it probably pays to give them as much skim-milk as they will consume, especially if there is abundance of it. If the supply is limited, skim-milk can be gradually reduced to 1 gallon per day after twelve to fourteen weeks, plus as much grass, roots, &c., as the pigs can consume. Where grain is the main feed-supply, it is wise to reduce the amount and let the pigs grow slowly on light rations from 70 lb. to about 110 lb. over a period of about eight to ten weeks. Three weeks' finishing should make them prime at about 140 lb. alive if their treatment has not been too hard.

If bacon is being produced, the slow-growth period can go on for eight months, till the pigs are 170 lb. live-weight. Three weeks' " topping off " on full rations makes them into baconers of 200 lb. live-weight.

A noteworthy feature is the trend of public opinion in the direction of a tuberculin-tested milk-supply. This is indicated by the requests of certain local authorities to have all cows supplying milk for human consumption inside their areas subjected to the tuberculin test. There can be little doubt that this requirement will extend, and it would appear that its application generally throughout the Dominion as a compulsory measure is not far off. In my report of last year I advocated its adoption, and I am convinced that it must be regarded as a sound forward movement in the interests of public health.—*Annual Report, Director of the Live-stock Division.*

APPLICATION OF ORCHARD SPRAYS.

III. SPRAY NOZZLES (*continued*).

G. G Taylor, Plant Diseases Division, Plant Research Bureau, Palmerston North.

Volume Delivery.

THE rapidity with which a complete coverage of spray can be obtained is dependent, to a large extent, on the rate at which spray is discharged from the nozzle (or combination of nozzles) in use. Volume delivery is a factor indicating the performance of any nozzle in this respect, the volume of water delivered in one minute being the standard used for comparing different nozzles. In practice, volume delivery is affected by the nature of the spray-mixture, but for comparative purposes such differences are not of practical significance.

EXPERIMENTAL METHOD.

The nozzles were directed into a wooden barrel for one minute. The water thus collected was weighed and the volume calculated by allowing 10 lb. for 1 gallon. Repeated measurements by this method showed that the maximum error was 0·05 gallons. The mean of two measurements was taken for each nozzle.

In collecting the water it was found necessary to keep the nozzle clear of the surface of the water, and to provide a loosely fitting lid to the barrel to prevent loss by splashing.

Pressure was varied by adjustment at the pump and measured by a pressure-gauge inserted a few inches behind the nozzle. Constructional differences in the various nozzle parts were identical with those previously used for testing distribution and fineness of spray droplets (see this *Journal*, Vol. 53, p. 68).

RESULTS.

Pressure.—Volume delivery showed an increase as the pressure was increased from 50 lb. to 300 lb. The rate of increase tended to diminish as the higher pressures were reached (Fig. 23) Increase in volume delivery with increasing pressure was greatest where disks having the largest apertures were used (Fig. 23).

Disk Apertures.—Increase in the diameter of disk apertures from $\frac{3}{64}$ in. to $\frac{4}{64}$ in., $\frac{5}{64}$ in., $\frac{6}{64}$ in., $\frac{7}{64}$ in., and $\frac{8}{64}$ in. increased volume delivery. The rate of increase varied according to the structure of the whorl-plate in use, being highest where the diameter or number of the openings in the whorl-plate was greatest or the angle of the openings was least (Fig. 24).

Thickness of Disk.—Increase in the thickness of disks from $\frac{2}{64}$ in. to $\frac{4}{64}$ in. caused a small reduction in volume delivery. Further increase in thickness to $\frac{6}{64}$ in. had no measurable effect.

Depth and Shape of Whorl-chamber.—Volume delivery showed a slight increase when the depth of the whorl-chamber was increased from 0·08 in. to 0·24 in.

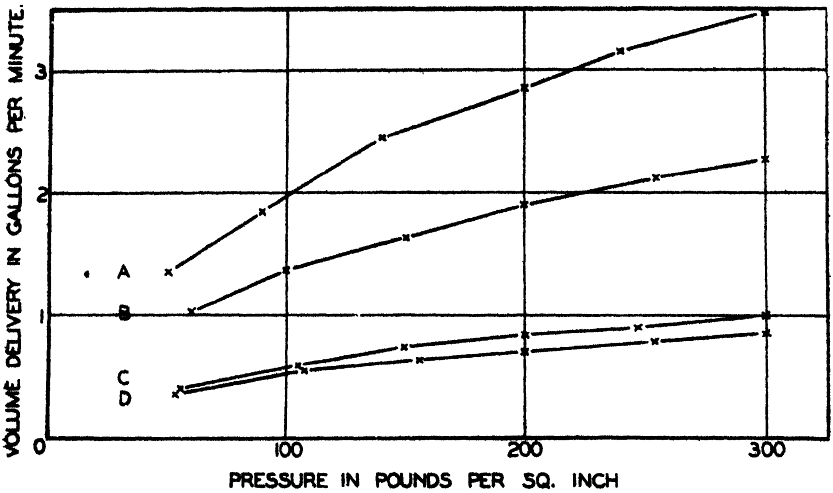

FIG. 23. EFFECT OF INCREASE IN PRESSURE ON VOLUME DELIVERY.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows :—

Curve A : Whorl-plate, six openings, $\frac{8}{64}$ in diameter ; angle, 22·5° ; disk aperture, $\frac{8}{64}$ in. diameter.
Curve B : Whorl-plate, six openings, $\frac{8}{64}$ in. diameter ; angle, 22·5° ; disk aperture, $\frac{4}{64}$ in. diameter.
Curve C : Whorl-plate, six openings, $\frac{4}{64}$ in. diameter ; angle, 22·5° ; disk aperture, $\frac{5}{64}$ in. diameter.
Curve D : Whorl-plate, six openings, $\frac{4}{64}$ in. diameter ; angle, 22·5°, disk aperture, $\frac{4}{64}$ in. diameter.

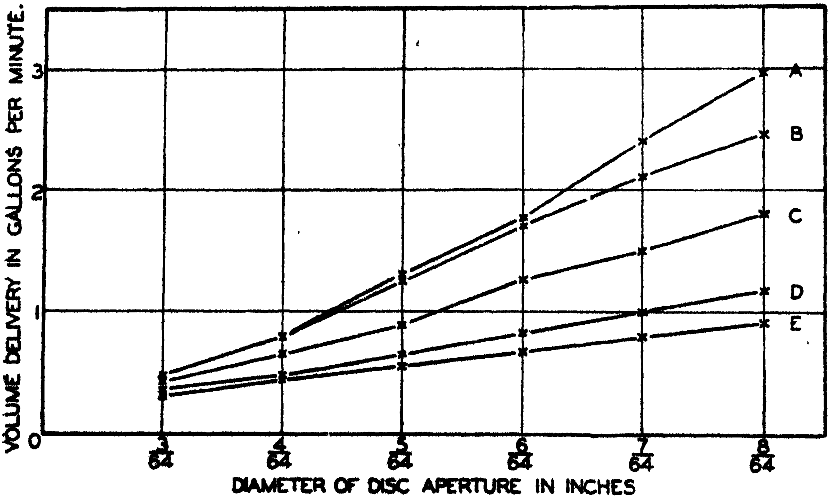

FIG. 24. EFFECT OF INCREASE IN DIAMETER OF DISK APERTURE ON VOLUME DELIVERY AT A NOZZLE PRESSURE OF 200 LB. PER SQUARE INCH.

The different curves show the effects produced when using whorl-plates of varying construction, as follows :—

Curve A : Whorl-plate, four openings, $\frac{12}{64}$ in. diameter ; angle, 45°.
Curve B : Whorl-plate, four openings, $\frac{5}{64}$ in. diameter ; angle, 22·5°.
Curve C : Whorl-plate, four openings, $\frac{5}{64}$ in. diameter ; angle, 67·5°.
Curve D : Whorl-plate, two openings, $\frac{5}{64}$ in. diameter ; angle, 67·5°.
Curve E : Whorl-plate, four openings, $\frac{4}{64}$ in. diameter ; angle, 45°.

The introduction of a ¼ in. diameter pin projecting approximately 0·04 in. from the centre of the whorl-plate into the whorl-chamber had no measurable effect on volume delivery. With the pin projecting 0·08 in. volume delivery was slightly reduced.

Diameter of Whorl-plate Openings.—Increasing the diameter of the whorl-plate openings from $\frac{4}{64}$ in. to $\frac{8}{64}$ in. and $\frac{12}{64}$ in. increased volume delivery. The rate of increase was highest where disks with apertures of the greatest diameter were used (Fig. 25).

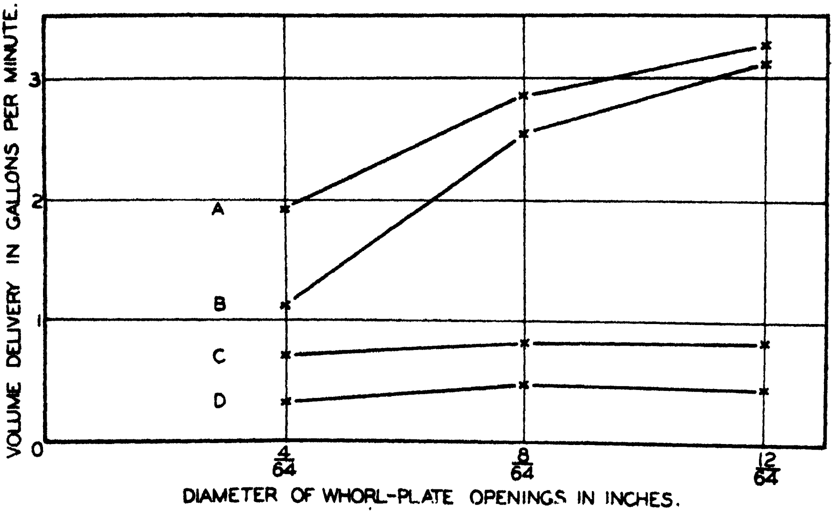

FIG. 25. EFFECT OF INCREASE IN DIAMETER OF WHORL-PLATE OPENINGS ON VOLUME DELIVERY AT A NOZZLE PRESSURE OF 200 LB. PER SQUARE INCH.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows —

Curve A. Whorl-plate, six openings; angle, 22·5°; disk aperture, $\frac{5}{64}$ in. diameter.

Curve B: Whorl-plate, six openings; angle, 22·5°; disk aperture, $\frac{4}{64}$ in. diameter.

Curve C: Whorl-plate, six openings; angle, 45°; disk aperture, $\frac{5}{64}$ in. diameter.

Curve D. Whorl-plate, six openings; angle, 45°; disk aperture, $\frac{4}{64}$ in. diameter.

Angle of Whorl-plate Openings.—In most instances volume delivery decreased as the angle of the whorl-plate openings was increased from 22·5° to 45° and 67·5° (Fig. 26). Where whorl-plates with openings $\frac{12}{64}$ in. in diameter were used, increase in the angle from 45° to 67·5° ***increased*** volume delivery (Fig. 26). This latter effect appeared to be due to the fact that with whorl-plate openings $\frac{12}{64}$ in. in diameter, increase in the angle of the openings from 45° to 67·5° increased the space available for direct flow of spray (Fig. 27), thus resulting in a reversal of the normal tendency for increase in the angle of the whorl-plate openings to ***decrease*** volume delivery.

The rate at which volume delivery decreased with increase in the angle of the whorl-plate openings was greatest where disks with the largest diameter openings were used (Fig. 26).

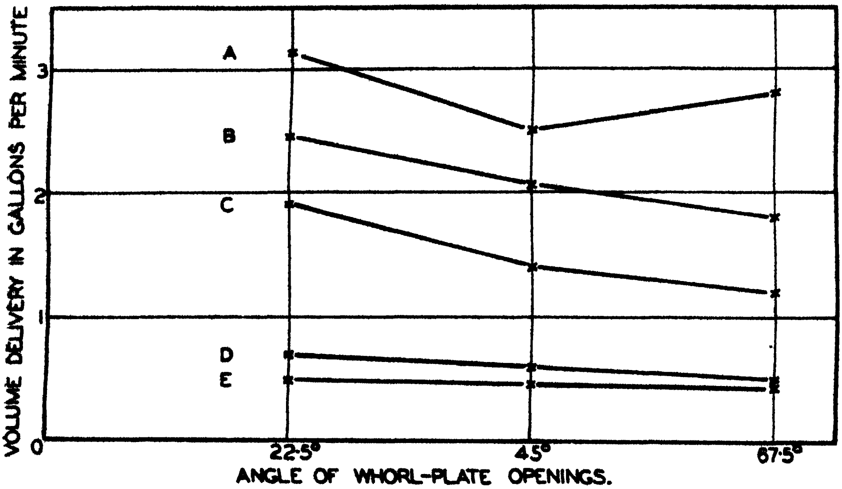

FIG. 26. EFFECT OF INCREASE IN THE ANGLE OF WHORL-PLATE OPENINGS ON VOLUME DELIVERY AT A NOZZLE PRESSURE OF 200 LB. PER SQUARE INCH

The *different* curves show the effects produced when using whorl-plates and disks of varying construction, as follows :—

Curve A : Whorl-plate, four openings, diameter, $\frac{12}{64}$ in , disk aperture, $\frac{8}{64}$ *in. diameter*

Curve B : Whorl-plate, four openings, diameter, $\frac{8}{64}$ in. ; disk aperture, $\frac{8}{64}$ in. diameter.

Curve C : Whorl-plate, four openings, diameter, $\frac{8}{64}$ in. ; disk aperture, $\frac{4}{64}$ in diameter.

Curve D : Whorl-plate, two openings, diameter, $\frac{8}{64}$ in. ; disk aperture, $\frac{8}{64}$ in diameter.

Curve E : Whorl-plate, two openings, diameter, $\frac{8}{64}$ in. ; disk aperture, $\frac{4}{64}$ in. diameter.

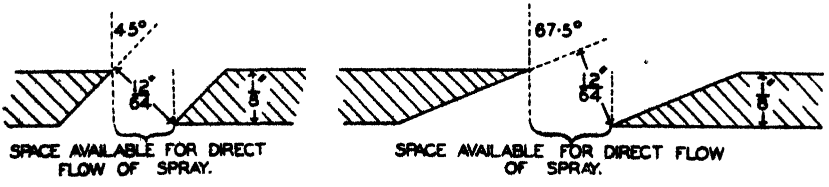
45°
12"
64
1"
8
SPACE AVAILABLE FOR DIRECT FLOW OF SPRAY.
67·5°
12"
64
1"
8
SPACE AVAILABLE FOR DIRECT FLOW OF SPRAY.

FIG. 27. SECTIONS OF WHORL-PLATE SHOWING INCREASE IN THE AVAILABLE SPACE FOR DIRECT FLOW OF SPRAY WHEN THE ANGLE OF OPENINGS OF $\frac{12}{64}$ IN. DIAMETER IS INCREASED FROM 45° TO 67·5°.

Number of Whorl-plate Openings.—Increase in the number of whorl-plate openings from two to four and six increased volume delivery. The rate of increase was greatest where disks with apertures of the largest diameter were used (Fig. 28).

Strainer.—The use of a strainer caused a slight decrease in volume delivery.

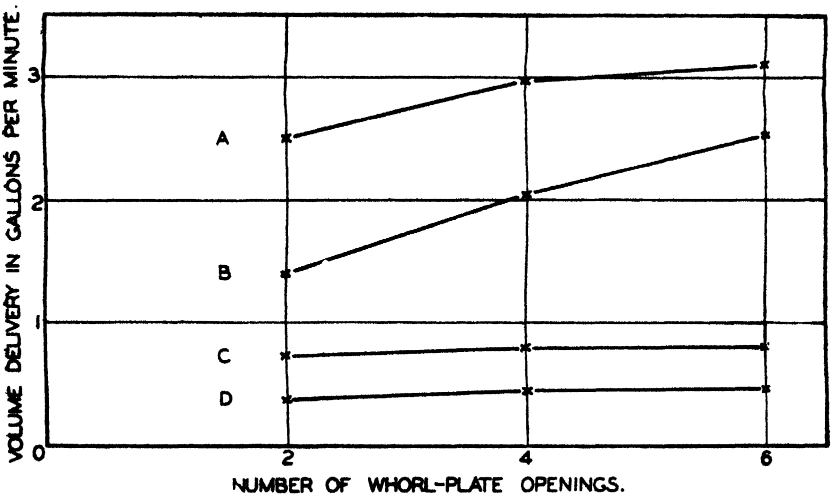

FIG. 28. EFFECT OF INCREASE IN THE NUMBER OF WHORL-PLATE OPENINGS ON VOLUME DELIVERY AT A NOZZLE PRESSURE OF 200 LB. PER SQUARE INCH.

The different curves show the effects produced when using whorl-plates and disks of varying construction, as follows:

Curve A. Whorl-plate openings, $\frac{12}{64}$ in. diameter; angle, 45°; disk aperture, $\frac{8}{64}$ in. diameter.

Curve B. Whorl-plate openings, $\frac{12}{64}$ in. diameter; angle, 45°; disk aperture, $\frac{4}{64}$ in. diameter.

Curve C. Whorl-plate openings, $\frac{3}{64}$ in. diameter; angle, 45°; disk aperture, $\frac{8}{64}$ in. diameter.

Curve D. Whorl-plate openings, $\frac{3}{64}$ in. diameter; angle, 45°; disk aperture, $\frac{3}{64}$ in. diameter.

NOZZLE-CONSTRUCTION IN RELATION TO ORCHARD PRACTICES.

DISCUSSION.

It is apparent that with variation in nozzle-construction differences can be obtained in the angle of the spray-cone, size of spray droplets, depth of penetration, and volume delivery. The most significant factors affecting the performance of the nozzle appear to be nozzle pressure, diameter of disk aperture, and the diameter, number, and angle of the openings in the whorl-plate. The effects of these are summarized below:—

Increase in	Effects on			
	Size of Droplets.	Angle of Cone.	Depth of Penetration.	Volume Delivery.
Pressure ..	Considerably decreased	Increased at first then slightly decreased	Increased ..	Increased
Diameter of disk aperture	Slightly increased	Considerably increased	Increased ..	Considerably increased
Diameter of whorl-plate openings	Increased ..	Considerably decreased	Considerably increased	Considerably increased.
Number of whorl-plate openings	Slightly increased	Decreased ..	Increased ..	Increased.
Angle of whorl-plate openings	Slightly decreased	Increased ..	Decreased ..	Decreased.

It has been shown that variation in nozzle pressure and in the construction of the different nozzle parts does not have constant effects owing to the relationship which exists between the several factors involved. For example, increase in volume delivery with increase in the diameter of the disk aperture may be great or small according to the construction of the whorl-plate. Variation in any one factor may improve nozzle performance in certain respects but be detrimental in others. For example, increased penetration may be obtained by whorl-plate adjustment, but at the same time the angle of the spray cone is reduced and the size of spray droplets increased. Thus it will be seen that before the exact performance of any nozzle can be determined, a complicated set of inter-related factors must be considered. Under practical conditions, however, it appears that nozzle pressure is of greatest significance in influencing the size of spray droplets, disk aperture in determining volume delivery and the angle of the spray cone, and whorl-plate construction—*i.e.*, diameter, angle, and number of openings—in varying the depth of penetration.

The general effects as summarized in the above table are substantially the same as those recorded by other workers (see this *Journal,* Vol. 53, p. 68, Table I) save that in the present investigations increase in the diameter of the disk aperture was found to cause a small increase in the size of spray droplets.

Alterations in the depth of the whorl-chamber and in the thickness of the disk were found to have effects similar to those recorded by other workers. Their effects, however, do not appear to be of sufficient magnitude to be of practical significance. The use of a strainer does not materially affect the performance of the nozzle.

TYPES OF NOZZLE AVAILABLE

The nozzles used in orchard practice are all based on the "cyclone" principle, but vary considerably in the details of construction. Two main types are involved—(*a*) fixed nozzles in which adjustment can only be made between intervals of spraying, and (*b*) spray-guns in which adjustment can be made while spraying is in progress.

Fixed nozzles are used singly or in groups of two or more on light-metal tubes of from 3 ft. 6 in. to 7 ft. in length, the whole unit usually being termed a "spray-rod." Frequently the only adjustment possible is by replacement of the disks. This allows for considerable variation in the diameter of the spray cone and in volume delivery, but not for sufficient adjustment in depth of penetration. In improved types provision is made either for replacement of the whorl-plate or for alteration in the size and angle of the whorl-plate openings, thus allowing for greater variation in the depth of penetration. The nozzles used with spray-rods are usually set at an angle in order to assist coverage of inaccessible portions of the trees such as the under surface of leaves, &c.

Spray-guns are about 20 in. in length and each consist of a tube of ¾ in. to 1 in. diameter with the nozzle at one end and a handle at the other, the latter being connected with the nozzle by a rod passing through the tube. A pressure-tight gland is used where the rod leaves the tube. By twisting the handle, adjustment of the nozzle can be effected and the depth of penetration varied without interruption in spraying. In one type of gun the size of the whorl-plate openings is adjusted by means of a revolving plate, and in another the size of a central opening in the whorl-plate is varied by means of a retractable plunger. Similar methods to these, in which variation in the total extent of the whorl-plate openings is the principle involved, are adopted for most guns. With the short guns usually employed, angle nozzles cannot be conveniently used. It is possible, however, to obtain guns of up to 6 ft. in length, and with these angle nozzles can be used with advantage.

The principal advantage of the spray-gun lies in the readiness with which the depth of penetration can be varied There is a tendency, however, to ignore the size of the trees or portion of the tree being sprayed and to "set" the gun to give a narrow cone of coarse droplets of spray having maximum penetration. This simplifies spraying, but increases the likelihood of missing portions of the trees and often results in wastage of spray. With careful usage equally good results can be obtained with spray-guns as with spray-rods, but under average orchard conditions greater efficiency is likely to be obtained with the latter

RECOMMENDATIONS.

The practical significance of volume delivery, size of spray droplets, &c., on spray coverage and in disease-control will be dealt with in subsequent papers. In the meantime the following tentative suggestions are made as regards nozzle-type :—

Spray-rods—Suitable lengths vary from 4 ft. 6 in. to 6 ft., shorter rods losing the advantage of proximity to the higher parts of the trees, &c., and longer rods being too cumbersome to handle. Single nozzles are frequently employed, but double nozzles used on a Y or T piece appear to be more efficient owing to the greater width of the combined spray cones and the better distribution of spray droplets.

For the majority of New Zealand orchard trees double nozzles similar to the type illustrated in Fig. 2 (see this *Journal*, Vol. 53, p. 68) are suitable provided dimensions are as follows:—

Whorl-plates: $\frac{1}{8}$ in. thick and $1\frac{3}{16}$ in. diameter, with six openings of $\frac{1}{8}$ in. diameter centred on a circle $\frac{5}{8}$ in. diameter, and drilled at an angle of 45°.

Whorl-chambers: Approximately $\frac{1}{8}$ in. deep.

Disks: $1\frac{5}{16}$ in. diameter and approximately $\frac{3}{64}$ in. thick with the diameter of the apertures $\frac{3}{64}$ in. for summer use and from $\frac{4}{64}$ in. for winter use.

Increased penetration for large trees may be obtained by reducing the angle of the whorl-plate openings to 22·5°. If the increased penetration thus obtained is still insufficient, it may be necessary to use a single nozzle with six openings of $\frac{10}{64}$ in. diameter set at an angle of 22·5° and to increase the diameter of the disk aperture up to $\frac{8}{64}$ in. Nozzle pressure should be 250 lb. to 300 lb.

Many of the nozzles used with spray-rods vary from the types described above in number and construction. These give efficient service provided (*a*) that sufficient penetration is obtained, (*b*) that the width of the combined cones of spray is sufficient to assure that portions of the trees are not left unsprayed, and (*c*) that the volume delivery is such that maximum coverage can be obtained in minimum time. Volume deliveries of 3 gallons to 3·5 gallons per minute are sufficient for summer spraying of most trees, and 2·25 gallons to 2·75 gallons for winter spraying. For small trees volume delivery may be reduced slightly, and where the trees are large it may be increased to 4 gallons to 4·5 gallons per minute with advantage.

Spray-guns.—The most desirable types of spray-guns are those in which a fairly rapid and continuous change can be effected from a wide angle to a narrow angle cone of spray. Certain guns are undesirable in that there is a rapid change from a wide to a narrow cone at one point in the adjustment, making it difficult to obtain accurately any intermediate type of spray cone.

Volume deliveries of different guns vary so that the required disk-size should be found by trial. To this end the amount of spray delivered in one minute should be collected and measured, and those disks used which give a maximum volume delivery of approximately 3·5 gallons for summer and 2·5 gallons for winter use. For most guns disk-sizes of approximately $\frac{8}{64}$ in. and $\frac{6}{64}$ in. will be found suitable for summer and winter use respectively. For gun increased nozzle pressure is desirable, 300 lb. to 350 lb. being required for efficient working.

The volume deliveries of the spray-rods and guns indicated above are higher than are generally employed by growers and in some instances may be too great for the pump in use to supply. It is necessary, therefore, that the relationship between nozzle and pump capacity should be considered when determining the type of nozzle to be used (see this *Journal*, Vol. 52, p. 34).

COCCIDIOSIS IN POULTRY.

L. W. N. Fitch, Veterinary Laboratory, Department of Agriculture, Wallaceville.

Coccidiosis is probably the most serious disease of fowls in New Zealand. It occurs in all parts of both Islands, and losses are frequently heavy. There are two main forms, caused by different species of coccidia. One species attacks young chickens, which may show serious signs of parasitism at the early age of ten days, and this attack, if survived, does not protect them from the second species which affects them as pullets, just at the age when they might be expected to be coming into production.

The cause of coccidiosis is a protozoan or unicellular organism of microscopic dimensions, known as a "coccidium." Its life cycle is of very great biological interest, besides being of practical importance from the viewpoint of control.

Coccidia have two methods of reproduction—sexual and asexual. The former enables the parasite to survive apart from its host, while the latter ensures its rapid multiplication and invasion of its host's tissues once infection has been achieved.

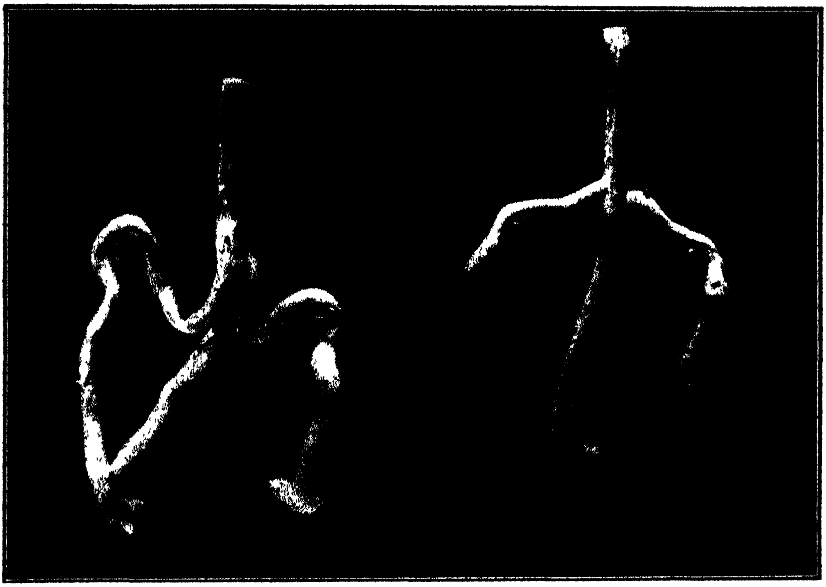

FIG. 1. SHOWING NORMAL (LEFT) AND AFFECTED (RIGHT) BLIND GUT TAKEN FROM CHICKENS

Affected blind gut filled with blood-clots resulting from hæmorrhage from damaged lining

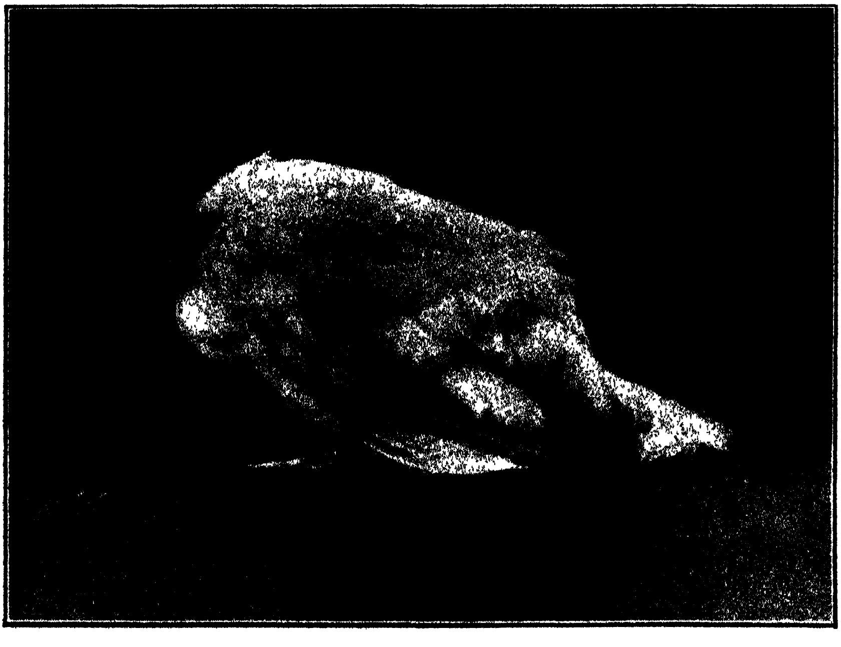

FIG. 2. PULLET ACUTELY AFFECTED WITH COCCIDIOSIS.

Unable to stand upright owing to general debility.

LIFE CYCLE.

Briefly the life cycle of coccidia is as follows: The form found in the excreta is known as the oocyst. This is a small oval or round body which can be seen only with the aid of the microscope. The oocyst is covered with a protective membrane which enables it to withstand weathering for long periods—up to at least a year under suitable conditions. It will not withstand prolonged drying or sunlight. The oocyst contains a central mass of material known as the nucleus, which, under favourable conditions, divides into four parts (sporocysts), each of which again divides into two parts (sporozoites). The oocyst with its eight contained sporozoites gains access to the gut of a bird via its food or drinking water, and there the action of digestive juices breaks down the cell-wall and the sporozoites are liberated. These latter, being motile, are capable of invading the cells lining the wall of the intestine. Once in the cell the sporozoite enlarges and divides into a large number of small organisms (merozoites) which are liberated into the bowel and infest fresh cells. This is the asexual form of reproduction and that chiefly responsible for the multiplication of the parasites. A variation in the above sequence, however, results in the formation from merozoites which have invaded gut cells of two different forms, one male and the other female. The fertilization of the former by the latter, after their liberation from the cell into the lumen of the gut, results in the formation of an oocyst, which is the form excreted in the droppings and that responsible for the spread of infection. This represents the sexual form of reproduction.

SYMPTOMS OF COCCIDIOSIS.

The severity of the disease varies widely. In some outbreaks the course may be very acute, with sudden, heavy mortality. In others the course may be chronic, with progressive emaciation and losses spread over a longer period.

In young chicks the former type usually occurs. The birds suddenly begin to die, the chief symptoms being diarrhœa, with blood-stained droppings. This is very useful in diagnosis of the condition. It is due to the extensive damage done to the lining membrane of the blind guts (there are two cæca in the fowl). In this form of coccidiosis the infection is usually chiefly confined to this region. The livers, however, in some cases may be grossly affected, showing extensive mottling. This is due to damage caused by coccidia which have passed from the intestine to the liver via the bile-ducts. On post-mortem the blind guts will often be seen to be filled with blood-stained material, or even, in very acute cases, with actual blood. In others the cæca may be filled with an offensive smelling, pasty, yellowish material. In less acute cases the birds huddle together, become droopy and ruffled, and lose their appetite. Death is less sudden.

In older birds the onset is more insidious. The birds become unthrifty and pale. They lose weight and become emaciated, frequently showing a weakness of the legs. As against the case of young ckicks, pullets are mainly affected in the upper part of the small intestine—(*i.e.*, that part immediately following the gizzard). Here, again, much damage may be done the bowel-wall, but the naked eye changes are not so obvious as in the acute type met with in young chicks. The bowel may be dilated and the lining membrane is covered with a catarrhal exudate, which gives it a rough, fluffy appearance when compared with the normal.

TREATMENT.

It will be clear from the life cycle that there are two points at which we might direct our attack. The first is while the parasite is in the gut of its host, and the second is the sexual stage the oocyst, which is excreted in the droppings.

It has long been realized that the first form of approach was of very limited value. Coccidia in the bowel are very resistant to drugs. Recently, however, two forms of medicinal treatment have been fairly widely advocated, and where more strenuous methods are impracticable, or conditions suitable, these might be attempted. The first of these measures consists of feeding large amounts of milk, the idea being that the contents of the intestines become more acid than usual, and thus the development of the infection is checked. The second involves the use of iodine. This is given in combination with milk, as follows: iodine, 1 part; potassium iodide, 2 parts; water, 50 parts.

This forms the stock solution which is prepared for use by mixing with fresh or skim-milk in the proportion of 1 part of stock to 9 parts of milk This mixture is heated gently until it becomes white and added *ad lib* to the drinking-water. The iodine-milk mixture should be made fresh daily.

It will be realized readily that the above measures only benefit the birds treated, and actually they only assist these to a limited extent. The birds still continue to excrete infective material, and it is at this stage that we must direct our efforts. Affected birds constitute a great danger, as they provide a source of reinfection for other birds.

It cannot be too strongly stressed that prevention of infection is by far more important in the control of coccidiosis than are curative measures. The source of infection must be removed, or, at least, limited as far as possible. All obviously infected birds should be destroyed and buried deeply, or, far preferably, burnt. They are a menace to the rest of the flock, and must not be kept. This is very important and a point which many poultry-keepers fail to appreciate. A sick bird is not worth anything in the market, and should be prevented from doing any more damage Medicinal treatment is useless in acute cases, as also in advanced chronic cases showing emaciation. It may be of value in those cases of coccidiosis in which a diagnosis has been established in the laboratory, and where the symptoms are merely unthriftiness, unaccompanied by advanced emaciation. In such cases medicinal treatment should be combined with preventative methods.

Young birds should be reared on wire netting to minimize chances of reinfection from infective droppings. Droppings should be removed and buried deeply, or, preferably, burnt. This is to be done every two days, this being the time required for the occyst to become infective.

Oocysts are very susceptible to heat, dryness, and sunlight. Boiling water with caustic soda, or the blow-lamp, are useful in cleaning brooder houses, shed-floors, perches, &c. These may be white-washed, or, in the case of perches and uprights, painted with boiling tar. Incubators, especially trays, should be washed with a 5-per-cent. carbolic-acid solution and allowed to dry.

Where possible, birds should not be run on infected country. Liming of surface soil and frequent turning to expose oocysts to sunlight is a useful measure. It must be remembered that oocysts may survive in soil under favourable conditions for at least a year.

Infected birds should not be removed to "clean" ground as they will rapidly contaminate it. Only newly hatched chickens from "clean" incubators and brooder houses should be put on to such new territory.

Where practicable, attendants handling infected birds should have no contact with healthy stock. Where this is impracticable, the attendant should thoroughly wash and disinfect hands and gum boots with a disinfectant solution, such as hypochlorite, before leaving infected premises.

In view of the possibility of eggs becoming contaminated by oocysts while passing through the cloaca, it is desirable to adopt some form of disinfection of eggs before incubation. Eggs should be washed in methylated spirits, allowed to dry, and then dipped in perchloride of mercury (a solution of 1 part in 2,000 of water) before setting them.

Finally, again it is desirable to emphasize the necessity for the most persistent and energetic measures in the campaign against coccidiosis.

SPOTTED-WILT ON TOBACCO.

G. G. TAYLOR and E. E. CHAMBERLAIN, Plant Diseases Division, Plant Research Bureau, Palmerston North.

THE virus disease spotted-wilt has already been recorded on tomatoes in New Zealand (Chamberlain and Taylor, 1936). For the past four seasons the same disease has been present on tobacco in the Auckland and Bay of Plenty Districts, where it has been known as "black-wilt." During the 1934-35 and 1935–36 seasons it has appeared on tobacco grown for experimental purposes at Palmerston North.

Although spotted-wilt is of world-wide distribution, the only record of its being of economic significance on tobacco is from South Australia (Samuel and Bald, 1933). It has, however, been recorded as causing losses of 35 per cent. in experimental plots at Perth, in Western Australia (Pittman, 1934). A disease causing heavy losses on tobacco in certain districts in South Africa may also be caused by the same virus (Moore, 1932 and 1933).

SYMPTOMS.

In the field the first symptom of spotted-wilt is the occurrence of necrotic areas on the young leaves. Necrosis spreads rapidly on the young growth, and the leaves at the growing-point become brown and withered (Fig. 1). At the same time growth ceases, so that infected plants soon appear noticeably stunted. The symptoms are most pronounced on young plants still in the rosette stage, for within a few days of the appearance of the disease most of the leaves show a marked necrosis and wilting (Fig. 2), and within a week or so the plants wither and die. On older plants a dark-brown or black streak appears on one side of the stem, and the top of the plant tends to curl over to that side (Fig. 3). Necrosis is at first present only on young leaves at the growing-point and on the older leaves on the side of the plant on which the streak occurs (Fig. 1). The more mature leaves, especially those at the base of the plant, often remain free from necrosis, but cease to grow and also ripen prematurely. Infected plants sometimes send out apparently healthy laterals, but these eventually develop spotted-wilt symptoms.

The foliage symptoms vary considerably. On young leaves necrosis first appears along the veins, but rapidly extends until the whole leaf becomes brown and wilted (Fig. 2). On older leaves necrosis often appears at first along the small veins, thus producing a network of bronzed tissue, but later spreads to form large necrosed areas (Fig. 4). Occasionally the only symptoms to appear are dark streaks along the larger veins. On rapidly growing leaves the formation of such streaks is sometimes accompanied by a bending of the mid-rib to one side, thus producing a distortion of the leaf. The colour of the dead tissues varies from light brown to almost black. On the older leaves the symptoms are invariably more pronounced towards the base of the leaves (Figs. 1 and 4).

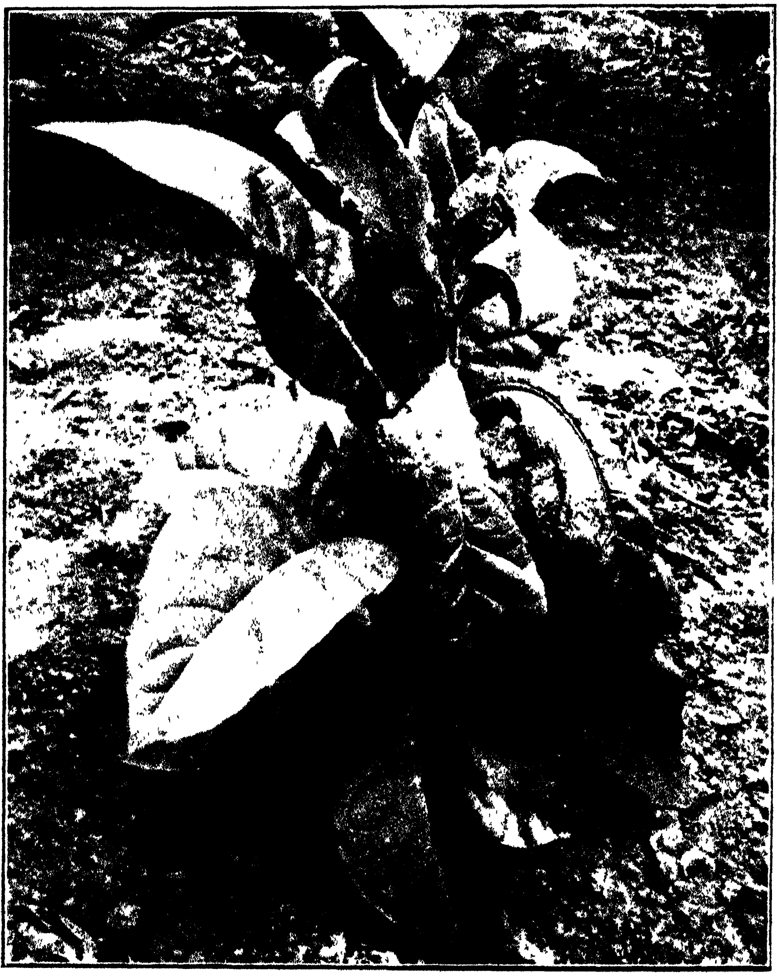

FIG. 1. SPOTTED-WILT ON TOBACCO

An early stage of infection.

[*Photo by H. Drake.*

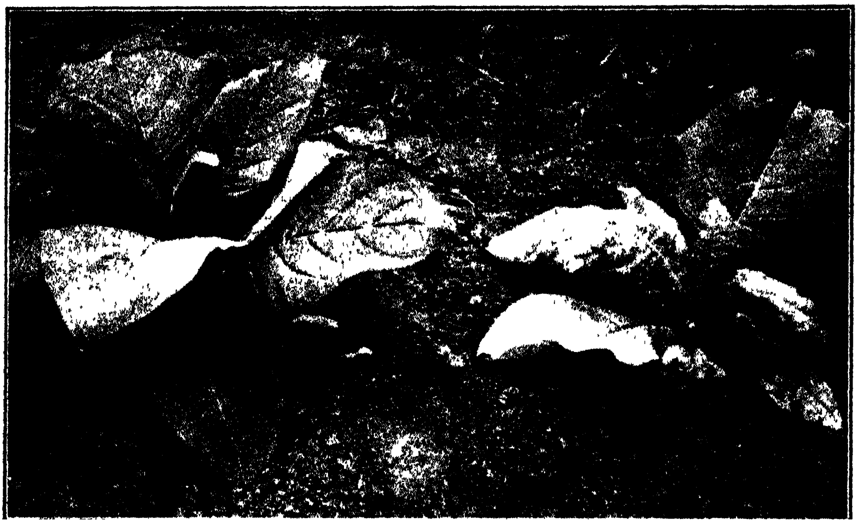

FIG. 2. SPOTTED-WILT ON TOBACCO.

Infection on a young plant. Healthy plant on left.

[*Photo by H. Drake.*

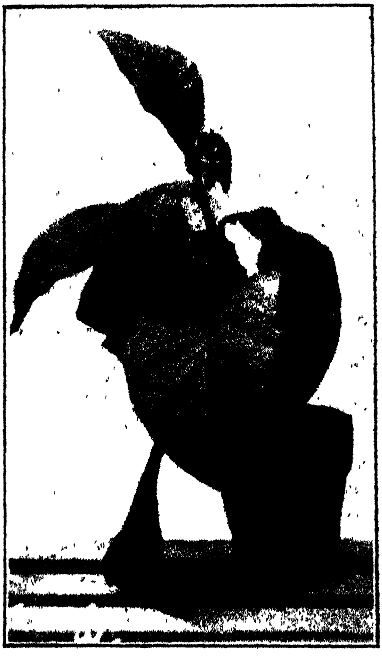

FIG. 3. SPOTTED-WILT ON TOBACCO.

Showing curling over of top. Plant grown in the glasshouse.

[*Photo by H. Drake*

INCIDENCE AND ECONOMIC SIGNIFICANCE.

Spotted-wilt first became of economic significance on tobacco in New Zealand at Pongakawa, in the Bay of Plenty, during the 1932-33 season. In that season up to 25 per cent. infection was reported from individual crops. Although the disease has been present each year since then, the losses have been slight. Spotted-wilt has also occurred for several seasons in commercial plantings at Auckland and Waikeria.

Diseased plants generally represent a total loss, since they rarely yield any curable leaf and infection usually takes place too late in the season for replacements to be made.

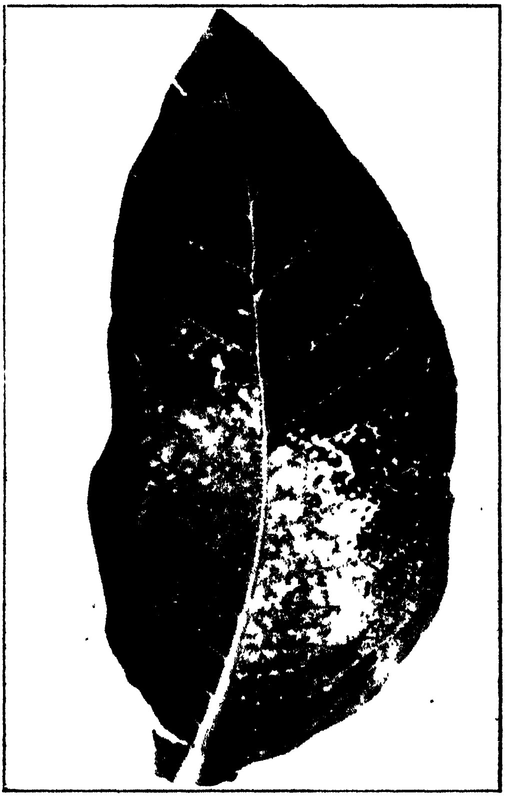

FIG. 4. LEAF SYMPTOMS OF SPOTTED-WILT ON TOBACCO.

Showing network of necrosed tissue and the formation of larger necrotic areas

[*Photo by H. Drake.*

IDENTITY WITH SPOTTED-WILT ON TOMATOES.

During the investigations of spotted-wilt of tomatoes and of the so-called "black-wilt" of tobacco it was found that these two diseases produced identical symptoms when transmitted by artificial inoculations* to tobacco and tomatoes in the glasshouse. It would appear, therefore, that the disease on either host is brought about by the same virus.

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* Throughout these investigations all transmission experiments were carried out by the leaf-rubbing method of artificial inoculation. For details of this method and a description of the symptoms of spotted-wilt on glasshouse-grown tobacco and tomatoes, see Chamberlain and Taylor (1936).

Table I gives the results of experiments on the transmission of spotted-wilt from tobacco to tobacco and tomatoes. In all cases the source of inoculum was naturally infected tobacco-plants collected in the field.

Table I.—Artificial Transmission of Spotted-wilt from Tobacco to Tobacco and Tomatoes.

Date of Inoculation.	Locality *	Species of Plants inoculated.	Number of Plants inoculated.	Number of Plants infected.	Inoculation Period.	
					Primary Symptoms.	Secondary Symptoms.
					Days.	Days.
22/1/36 ..	Palmerston North	Tobacco ..	12	6	4	8
14/2/36 ..	Pongakawa ..	,, ..	8	1	11	30
17/3/36 ..	,, ..	,, ..	16	5	7	10
19/12/34	Palmerston North	Tomatoes	5	2	..	23
22/1/36 ..	,,	,,	12	11	..	12
14/2/36 ..	Pongakawa ..	,,	8	2	..	15
17/3/36 ..	,, ..	,,	8	2	..	11

* This column gives the locality from which the diseased material was collected.

Check plants equal in number to those inoculated all remained healthy.

METHODS OF SPREAD, HOST-RANGE, AND OVERWINTERING.

Work in Australia has shown that spotted-wilt is spread by means of thrips. Two species were found to be responsible for transmission: *Thrips tabaci* (Pittman, 1927) and *Frankliniella insularis* (Samuel, Bald, and Pittman, 1930). Thrips have also been found to transmit the disease in both Europe and North America (Smith, 1931; Gardner and Whipple, 1934). In New Zealand *Thrips tabaci* is of common occurrence, and preliminary experiments have shown that it is able to transmit the disease.

Since spotted-wilt may be transmitted by juice inoculation it is probable that a certain amount of spread takes place during the handling of the plants.

Spotted-wilt has a very wide host-range, the following being a few of the more common plants of the flower and vegetable garden which have been listed as susceptible: Nasturtiums, asters, zinnias, iceland poppies, chrysanthemums, potatoes (Bald and Samuel, 1931), petunias, dahlias (Smith, 1932), and cinerarias (Ainsworth, 1933).

To date no transmission of spotted-wilt has been secured through the seed of any of its hosts. The short-lived nature of the virus outside living tissues precludes the possibility of transmission through the soil. It would appear, therefore, that the disease must overwinter either on annuals which grow through the winter or on perennial hosts, such as dahlias, iceland poppies, potatoes, &c.

CONTROL MEASURES.

Until such time as the natural host-range of spotted-wilt under New Zealand conditions has been determined the following control measures are suggested.

Crops should be examined regularly and all infected plants rogued as soon as the disease can be recognized.* Not only is it necessary to remove infected tobacco-plants, but tomatoes growing in the vicinity of the crops should be inspected also and diseased plants taken out. All infected plants should be burned or deeply buried.

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* At Pongakawa rogueing has been practised since the disease made its first appearance in 1933, and it is probable that this has been responsible for keeping the disease in check during the last three seasons.

After handling infected plants the hands should be thoroughly washed with soap and water before working with healthy plants.

Since secondary growth may become infected and assist in the overwintering of the disease it is advisable to plough out all plants as soon as the crop is harvested.

ACKNOWLEDGMENT.

The writers wish to acknowledge the help given by Mr. C. Lowe, Tobacco Instructor, Department of Agriculture, Auckland, who kindly forwarded material and supplied information with reference to the incidence of the disease.

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THE FUNGI ASSOCIATED WITH MOULDY-CORE OF APPLES.

R. M BRIEN, Plant Diseases Division, Plant Research Bureau, Palmerston North.

THE condition known as mouldy-core has been prevalent for many years in New Zealand on certain varieties of apples, notably Delicious and Cleopatra (Cunningham, 1925). During the 1934–35 season, mouldy-core caused serious losses in crops of Delicious apples grown in the Auckland District. This investigation was carried out to determine the fungi responsible.

APPEARANCE OF THE CONDITION.

At the time of harvesting, the external symptoms on fruits infected with mouldy-core are sometimes difficult to detect, but often a slight yellowing of the ground colour on the base near the stem cavity is observed. This yellowing occurs in advance of the normal change of the ground colour from green to yellow. At a later stage premature ripening and drop of fruits and a slight bronzing of the skin round the points of the crown indicate the presence of the disease. A longitudinal section of an infected apple reveals internally a zone of brown, decayed tissue in the region of the core. (Fig. 1.) The seeds and seed-chambers are usually covered with fungous hyphæ. In some cases the discoloured area enlarges until the entire fruit decays.

DISCUSSION OF LITERATURE.

Peyronel (1921) recorded a core-rot of apples and pears in Italy caused by *Trichothecium roseum* Link., where entry had been made by way of the calyx. Cunningham (1925) recorded mouldy-core in New Zealand on certain varieties of apples (Delicious and Cleopatra) which possessed a large open passage (calycine sinus) between the calyx and the core. He considered that the disease was not due to any specific organism, as he had isolated species of *Penicillium*, *Aspergillus*, *Rhizopus*, *Botrytis*, and *Trichothecium* from infected apples. These fungi had made entrance through the open calycine sinus. Harrison (1935) carried out investigations into the cause of mouldy-core of Gravenstein apples in Nova Scotia, and showed that the percentage of infected fruits depended directly on the percentage of open core. This latter condition was attributed to rapid growth causing a break in the core tissues, leading to an opening in the calyx tube. The fungi present in apples so affected were found to be chiefly *Alternaria tenuis* Nees. and *Fusarium* sp.

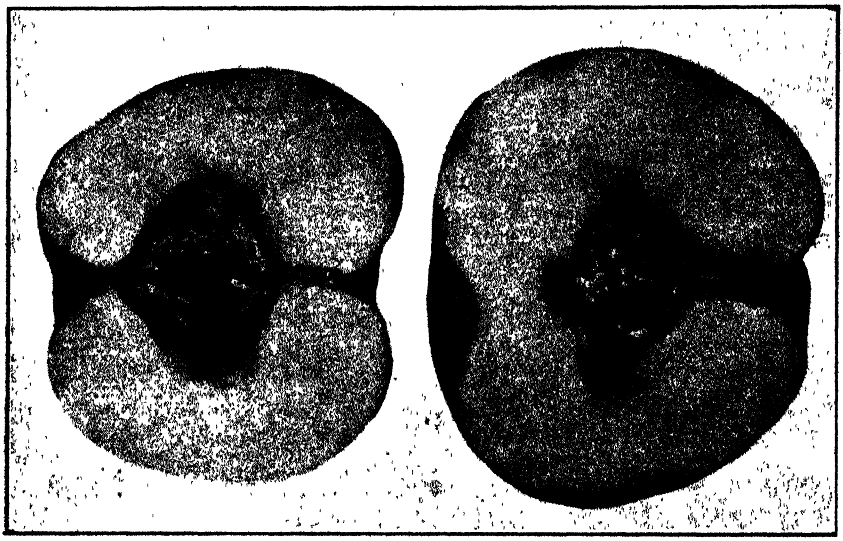

FIG. 1. MOULDY-CORE IN DELICIOUS APPLE

Note the large open calycine sinus.

[*Photo by H. Drake.*

EXPERIMENTAL METHOD.

For the purpose of the present investigation, consignments of Delicious apples showing symptoms of mouldy-core infection were forwarded to this laboratory by the Orchard Instructor, Auckland, from the Kumeu, Henderson, and Oratia districts. When these apples were examined it was found that in addition to mouldy-core infection, a number showed codling-moth infestation, entry being made through the calyx. Isolations were made both from fruits showing mouldy-core alone and from those showing mouldy-core plus codling-moth. The fungi obtained were isolated on prune agar, and transferred to potato dextrose agar for identification.

RESULTS.

From upwards of 800 isolations made from Delicious apples, the following fungi were obtained:—

(1) From apples showing mouldy-core only: *Gloeosporium perennans*, Zeller *et* Childs, 89·8 per cent.; *Fusarium lateritium*, Nees. var. *fructigenum*, 5·1 per cent.; *Septoria* sp., 2·5 per cent.; and *Phoma* sp., 1·2 per cent.

(2) From apples showing codling-moth and mouldy-core: *Gloesosporium perennans*, 45·8 per cent.; *Fusarium* spp., chiefly *F. lateritium* v. *fructigenum*, *F. culmorum* (W. Smith) Sacc., *F. orthoceras*, Appel *et* Wollenw., 15·5 per cent.; *Penicillium* sp., 10·3 per cent.; *Cladosporium* sp., 4·6 per cent., *Alternaria tenuis* Nees., 6·6 per cent.; *Rhizopus* sp., 5 per cent.; *Epicoccum granulatum* Penz., 1·6 per cent.; and *Pleospora* sp., 0·8 per cent.

Of the above fungi, the following have been proved pathogenic on apple fruits in New Zealand (Brien, 1934): *Gloeosporium perennans*, *Fusarium lateritium* v. *fructigenum*, *Alternaria tenuis*, *Rhizopus* sp. and *Pleospora* sp.

INCIDENCE OF MOULDY-CORE IN THE DELICIOUS CROPS AT AUCKLAND, 1934–1935.

An inspection of fifty-seven orchards in the Auckland District was made by Mr. W. K. Dallas, of the Horticulture Division, Department of Agriculture, Wellington. Delicious apples were selected at random from trees, from the ground, from orchard boxes picked by the grower, and from export rejects. Of 1,290 fruits examined, 40·8 per cent. showed mouldy-core infection. In addition, 82·2 per cent. of the total number of fruits examined showed open calycine sinuses, 16·7 per cent. almost closed and 1·1 per cent. closed.

CONCLUSIONS.

Mouldy-core in apples is caused by fungi which penetrate the calycine sinus. Some varieties possess an open sinus, which allows entry of organisms to the core, so that mouldy-core is due primarily to a defect in variety rather than to any specific organism. This is in accordance with the findings of previous workers cited herein. In New Zealand this defect appears to be enhanced by climatic and environmental conditions, because mouldy-core is not as prevalent elsewhere. As infection occurs by the passage of air or water borne spores through the open sinus, it is possible for any of the fungi listed above to gain entrance and ultimately produce the mouldy-core condition.

Thanks are due to Mr. W. K. Dallas, of the Horticulture Division, for collecting field data, and to Mr. L. Paynter, Orchard Instructor, Department of Agriculture, Auckland, for forwarding specimens.

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FARMERS' FIELD COMPETITIONS.

OTAGO AND SOUTHLAND DISTRICT, 1936.

Fields Division.

OTAGO can rightly claim to be the home of Farmers' Field Competitions in this country, for records reveal the fact that competitions were conducted in this province as early as 1895. In that year Sir John Bennett Lawes, Bart., of superphosphate fame, presented a 50-guinea challenge shield for the best-managed farm of from 100 to 400 acres in Otago or Southland. The competition was judged by Mr. P. Pattullo, Inspector for the New Zealand and Australian Land Co., and was won by Mr. G. H. Gilroy, of Stirling.

In 1897 field turnip competitions were introduced, Joseph Fison and Co., Ltd., offering two silver cups for competition, one for the best 5 to 15 acres of turnips and the other for the best 16 acres or over of the same crop. Messrs. Donald Reid and Co. also offered two cups, while other trophies were forthcoming from Messrs. Nimmo and Blair, Messrs. Wright, Stephenson, and Co., and from the Otago A. and P. Society who were sponsoring the movement.

During subsequent years the number of classes increased year by year until in 1901 there were eight classes for various crops, principally swedes, turnips, and mangolds.

An interesting class introduced the first year (1895) was a reaper-and-binder trial held at Outram, which trial attracted three competitors. These three entrants were manufacturers of machines, and as it was apparently not the intention of the Otago A. and P. Society to encourage such competitors the conditions were the following year changed, and the competition was open only to farmers, and no paid servant of any maker or expert was allowed to be with the machine. This competition attracted eleven entries.

These various competitions as outlined were continued up until 1917, when, possibly on account of the international upheaval, they were discontinued. During the past eight or ten years, however, various competitions have been carried out in Southland, and during the past season competitions have been resuscitated in Otago.

One of the main competitions held in Southland is the Prize Farm Competition. The autumn judging of this competition has yet to be carried out, so the final results are not yet complete for the 1936–37 season.

In the root-crop competition in Southland this season there were thirty-nine entries of swedes and six entries of turnips. The areas judged of these crops are 4 and 5 acres respectively. The entries were received from over a wide range of Southland, being as far apart as

Freshford, Papatotara, and Waikaka Valley. First place in swedes was secured by Mr. Jas. Stevenson, Wendon, with a crop of 85 tons 8 cwt. Mr. R. W. Maher filled second place with a crop weighing 77 tons 9 cwt., while Mr. J. Wilson's crop of 71 tons 9 cwt. was third. In soft turnips Mr. A. O. Fleming was first with a 48 tons 8 cwt. crop, while Mr. C. C. Munro was second with a 44 tons 8 cwt. crop, and Mr. F. G. Clark filled third place with a crop weighing 42 tons 10 cwt.

As already indicated, field competitions were revived in Otago this season. A committee representative of the Farmers' Union, Otago A. and P. Society, stock and station agents, and the Department of Agriculture was set up, and this committee acts as the central executive for all competitions throughout Otago. Owing to the extremely wide variation in soil types in this province and the diversified nature of farming it was decided to divide Otago into zones and make each competition complete within its own zone. By this means it was hoped to even up matters so that competitors would not be unduly handicapped by soil type and other factors over which they had no control. While it is realized that such a zoning could be by no means perfect in its object, the results of the first year's competitions were satisfactory, and only minor anomalies occurred.

WINNING SWEDE CROP IN OTAGO COMPETITIONS.

Grown by Mr. C. Morrison, Inch-Clutha; yield, 95 tons 16 cwt. an acre.

Classes for root crops, pastures, and live-stock were undertaken, and the measure of support afforded the competition in its initial year was very satisfactory. The only disappointing feature was the poor attendance of farmers at judging-time, but this feature of the work will grow as farmers come to realize the worth of competitions.

In the swede class there were forty-three entries extending over the Strath-Taieri, Inch-Clutha, Owaka, and Milton districts. The Inch-Clutha district, famous for its swede crops, easily headed Otago for crop-yields. The winning crop was that grown by Mr. C. Morrison, which weighed out at 95 tons 16 cwt. This is by no means the heaviest crop that has been weighed up in this district, swede crops in previous competitions having yielded over 100 tons per acre. When one realizes that these crops are in 28 in. ridges (as compared with the 14 in. and 21 in. drills commonly seen in the North) some idea of the excellence of the roots may be formed. The second heaviest crop this season was that of Messrs. Wilson Bros., which yielded 90 tons 11 cwt. per acre, while a second crop of Mr. C. Morrison's weighed 88 tons 18 cwt. The best crop in the Owaka district, grown by Mr. W. S. Bayne, yielded 58 tons 9 cwt., while in the Milton district a 47 ton crop grown by Mr. John Cameron topped the list, and in the Strath-Taieri district Mr. F. G. Glover was first with 61 tons.

The rules for the pasture competition were based on those adopted in Taranaki, but with minor adjustments to meet local conditions. For instance, the minimum area was increased from 3 acres to 10 acres, while the judging-points were also altered slightly. Good entries were received for the pasture classes, the districts competing including those of Central Otago as well as coastal districts, and the total entries were thirty-four. As the pastures have to be judged again in the autumn, no results of this season's pasture competition are yet available.

The live-stock competition this season consisted of a competition for ewe hoggets. Just as one or two roots in a winter show give no indication of the yield or utility of a crop, so it was felt that a small pen of ewe hoggets at an A. and P. show does not fully represent the quality of a farmer's flock. After all, it is the whole flock or farm unit that counts in farming, and not merely the cream of the stock or crops, and it was with a view towards bettering the quality of a flock as a whole that the ewe-hogget class was introduced. Having very little information as a guide, the committee had to draw up rules practically without precedent, and as a result of the first year's work it has been found necessary to make extensive alterations for the coming season. No stud sheep were eligible, and farmers had to submit to the judges a number of hoggets equal to 20 per cent. of the ewes put to the ram the previous season. There were two classes, one for ewe hoggets that in the opinion of the judges would build into a flock most suitable for the production of fat lambs and the other into a flock for straight-out wool-production. In the first class the points were—

Suitability for production fat lambs	50
Constitution	30
Wool	20
Total	100

while in the second class the points were—

Wool	50
Form and constitution	30
Breeding and quality	20
Total	100

In addition to these classes some districts introduced a special dual-purpose class, where the points were—

Wool	35
Carcass	35
Uniformity	30
Total	100

Four districts entered for the ewe-hogget competition, these being South Otago, Roxburgh, Maniototo, and the Lakes District. The total number of entries was fifty-seven.

The placings in the various districts were as follows:—

South Otago—	
Fat-lamb Class—	
First	W. Craigie, Owaka.
Second	Miss McPhee, Owaka.
Wool Class—	
First and Second	John Anderson, Waiwera.
Dual-purpose Class—	
First	Chas. Begg, Pukeawa.
Second	D. McKenzie, Waiwera
Third	W. Bradfield, Owaka.
Roxburgh District—	
Dual-purpose Class—	
First	F. Chittock, Kelso.
Second	H. Kirk, Kelso.
Third	Mrs. Potts, Crookston.
Wool Class—	
First	F J. Smith, Roxburgh.
Second	K. Wright, Roxburgh.
Third	G. Saunders, Roxburgh.
Maniototo District—	
Fat-lamb Class—	
First	Mrs. W. Blakeley
Second	S. O. Neill
Wool Class—	
First	Paul Clark.
Second	W. Gibson and R. Gibson (equal).
Dual-purpose Class—	
First	A. Stringer.
Second	G. Paterson.
Lakes District—	
Dual-purpose Class—	
First	D. Cockburn, Queenstown.
Second	J. L. Brown, Lower Shotover.
Third	Mrs. McLean, Queenstown.
Wool Class—	
First	T. M. Houston, Lower Shotover.
Second	W. S. Reid, Arrowtown.

The judging of the swede and pasture classes was carried out by officers of the Fields Division, while prominent breeders carried out the judging in the ewe-hogget classes.

LAYOUT AND HOUSING FOR DAIRY-FARM PIGGERY.

RECOMMENDATIONS OF THE MANAWATU-OROUA PIG RECORDING AND DEVELOPMENT CLUB.

W. J. CROUCHER AND E. P. NIELSEN, MANAWATU-OROUA PIG DEVELOPMENT AND RECORDING CLUB, PALMERSTON NORTH.

PIGS generally have shown that they are capable of earning a varying return under almost any type of housing-condition. In the main the tendency has been to put them on a piece of land unsuitable for other purposes, and to provide the least costly accommodation and equipment. Money invested in provision for pigs was not considered a live asset, and so little was invested. The pigs struggled along, yielded about half what they could yield, and the owner simply pocketed the returns as a matter of course and without any pride of achievement. Cows and sheep by contrast had money spent for efficient dairies, milking-machines, shearing-sheds, yards, and dips. Such conveniences made it easier to handle these stock, and enabled their full revenue-producing capacity to be exploited. With similar facilities pigs could show their worth and the owner be freed from some drudgery. Better conditions would make pigs more extensively profitable.

The guidance herein is based on actual experience of pig-raisers relative to the simplest and most economical means of securing breeding-stock, and management that will contribute to the quick growth and to the health of the pigs in every phase of their existence.

An important fact the truth of which has been clearly demonstrated is that no one feature alone will give complete success. It is not sufficient to rely upon the best of stock or type of pig if essential features of feeding and management are neglected. The best features of breeding, feeding, and management must be combined to secure consistently good returns, otherwise much well-intentioned labour and financial outlay may be without a suitable return.

Good housing is of fundamental importance in successful pig-raising, but it is of great practical moment to bear in mind also the well-proven fact that any expenditure on housing and in the runs attached thereto cannot give the desired results if the factor of common-sense control and management is not in evidence at all times, no matter how excellent the layout may be. Good management, independent of the strain and type of the pig, implies the wise application of acquired knowledge in every department, and particularly with respect to sensible feeding and management.

SOME RESULTS OF POOR HOUSING.

It is a fundamental principle in successful pig raising and fattening that big litters of quickly maturing stock show the best returns in the shortest time; hence it is essential that the feed and comfort

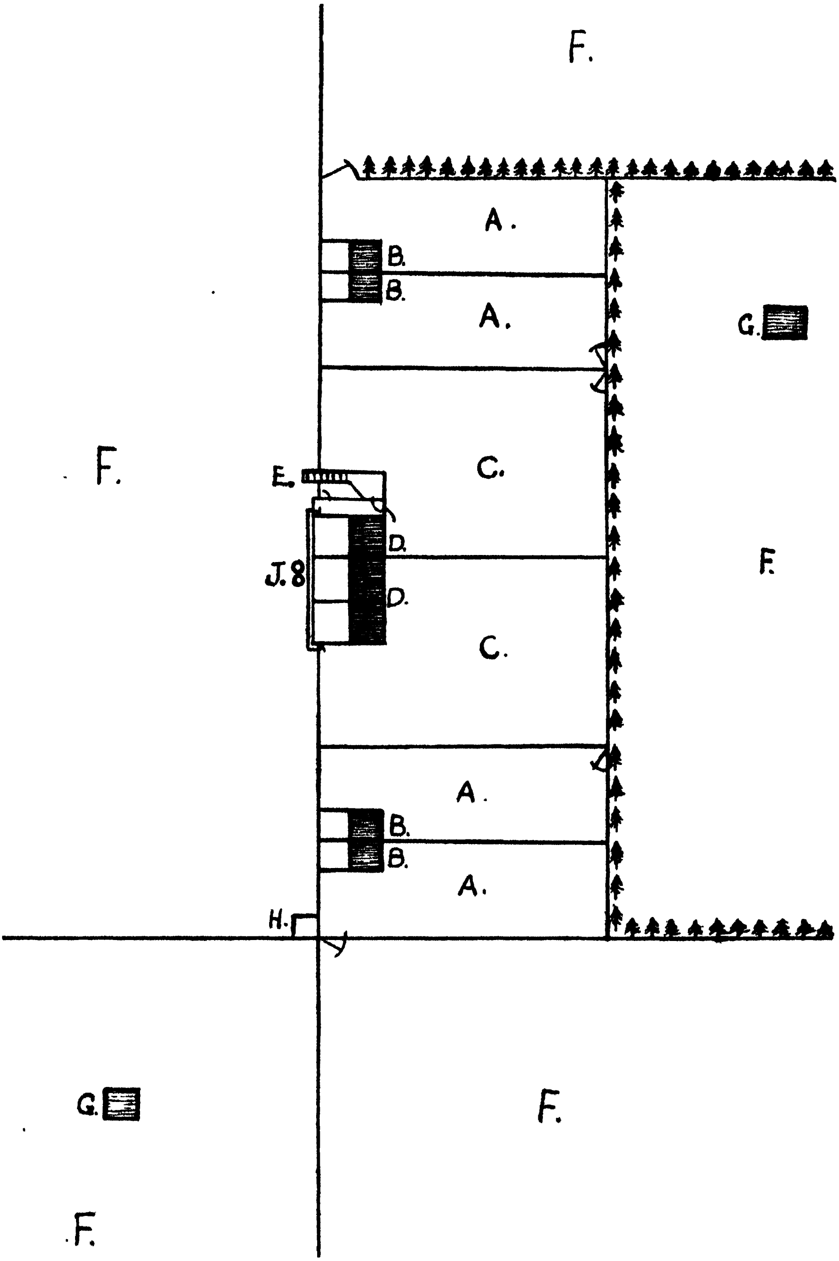

FIG 1. PIG-KEEPING LAYOUT NO. I.

A. Small grass accommodation and control pens with farrow-house and feed-yards, with access to cow pastures.
B. Farrow-house and feed-yard.
C. Grass run-out pens for fattening pigs.
D. Fattening-house.
E. Drafting-yards and loading-race.
F. Dairy-cow paddocks.
G. Movable shelters for breeding-sows, &c.
H. Feed area for pigs on cow pasture.
J. Skim-milk pumped to this point for central feeding.

of the pigs be studied at all times. Bad housing usually means unthrifty and unhealthy pigs. An enormous loss arises because of disease, most of which is preventable. Cold, wet, and insanitary conditions invite trouble which can be avoided. The present heavy loss from mortality in young pigs should be eliminated. Pigs are very susceptible to pulmonary diseases, of which pleurisy and kindred troubles are very prevalent. Foul and insanitary yards, sties, troughs, and wallows are ideal breeding-places for intestinal worms and other pig-parasites. Care in trying to produce healthy pigs under filthy conditions is often in vain, and although some succeed in producing good pigs under dirty conditions they are getting less for their feed than it is capable of producing. There are numerous cases in which money spent on equipment that makes

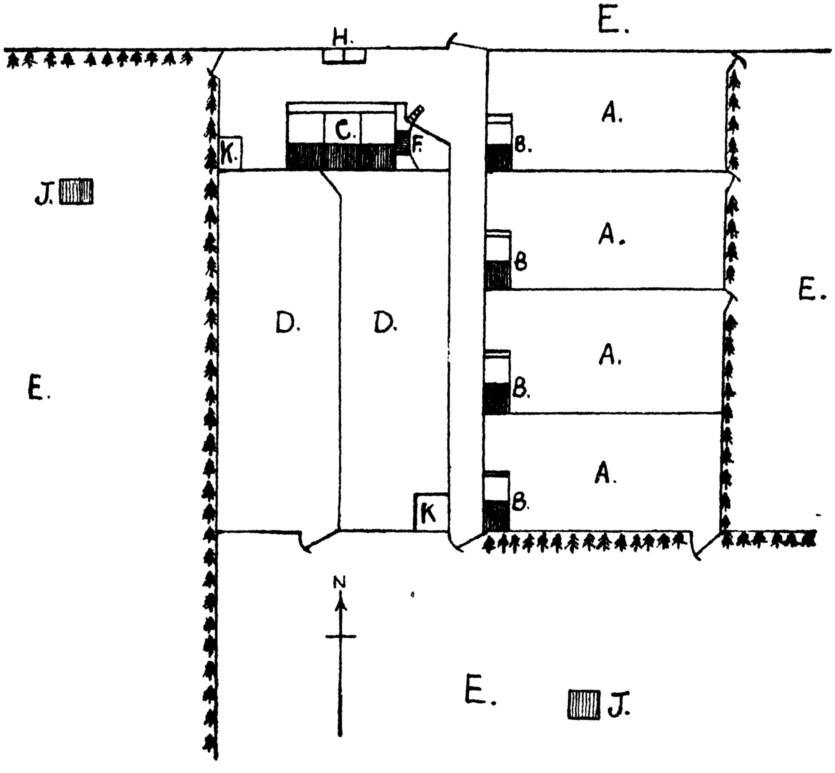

FIG. 2. PIG-KEEPING LAYOUT NO. 2.

A. Small grass accommodation and control pens attached to farrow units, with access to cow pastures.
B. Farrow units consisting of house, feeding-yard, and creep.
C. Fattening-house
D. Grass run-out pen for fattening pigs for exercise, health, and control
E. Dairy-cow paddocks and pastures for use of dry sows, sows and litters, young pigs until ready to place in the fattening-house, and for store pigs.
F. Drafting-yards. scales, and loading-race.
H. Meal-shed and copper
K. Concrete or metal feeding-areas for pigs on cow pastures.
J. Shelters for pigs on cow pastures.

cleanliness possible has been returned in the first season by a reduction in actual deaths on the farm or in the number of pigs condemned at slaughter. Pigs and filth need to be separated.

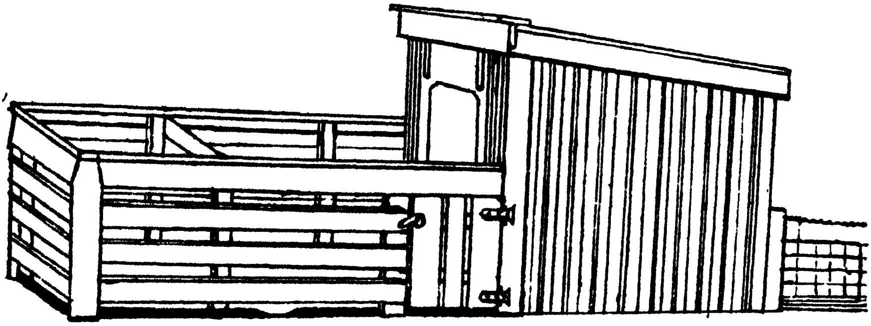

FIG 3 FARROWING-UNIT. TYPE 1. SEMI-CLOSED FRONT; POST AND RAIL YARD.

House 7 ft 6 in. deep by 7 ft. wide by 6 ft high front, 5 ft back Front boarded in at sides for 18 in —also top

Timber 8 ft. by 1 ft rough heart rimu; 3 in by ½ in. slats, 4 in by 2 in joists 3 ft by 2 ft purlins, rafters, and studs

Flooring, preferably tongued and grooved, with not less than 3 in fall to concrete yard. Farrow rail provided

Roofing 4 sheets 8 ft iron, lined with tarred paper, felting, or sacking, supported by wire-netting

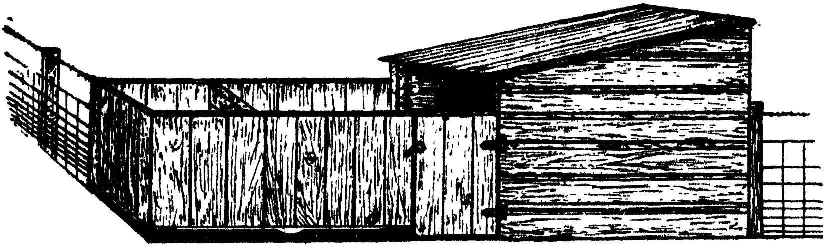

FIG 4. FARROWING-UNIT: TYPE 2 OPEN FRONT, OVERHANG FORWARD; ROOF SLOPED TO FRONT, CLOSE-BOARDED YARD

House: Specifications same as above—alternate timber—rusticating

Yard, concrete: 8 ft. by 7 ft. overall. Creep 2 ft 6 in by 7 ft Fall from house to corner and out of grass pen. 2 in. concrete kerbing, or lip, right round to prevent soiling of ground. Drainage to come into race to sump or open drain.

Railings In type 1, 6 in by 1 in O.B. 3 ft high Creep partition preferably movable In type 2, close-boarded yard: this more suitable for cold districts and unsheltered piggeries

GENERAL REQUIREMENTS.

Any system of housing should give efficiency at a reasonable cost. It is most important that the sleeping-quarters be rainproof and windproof. The walls should be constructed so as to prevent cold draughts of air reaching the pigs. The house should face the sun and give free access to its rays and fresh air. Provision for carrying off foul air should be made by ventilators placed at the top of the back wall. Fattening pigs should be provided with an out-run where they can get exercise when kept under the close-pen system. In the absence of grass runs green feeding-material should be placed in the sty. The series of plans for buildings and out-runs given herein is considered sufficient to cover the needs of every pig-keeper according to the size of his farm and the numbers of pigs handled. Individual judgment must be exercised in adapting the layout to the particular conditions of the farm with due regard both to efficiency and cost.

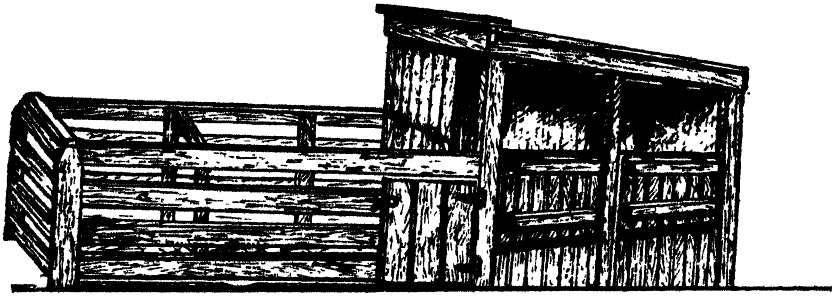

FIG. 5. FARROWING-UNIT: TYPE 3. CLOSED TYPE OF HOUSE, TWO SIDES WITH HINGED DOORS FOR SUN IN GOOD WEATHER.

House: Same overall specifications as in Fig. 4. Front and one side with top half hinged to open to sun and close in cold weather. Warmer type.

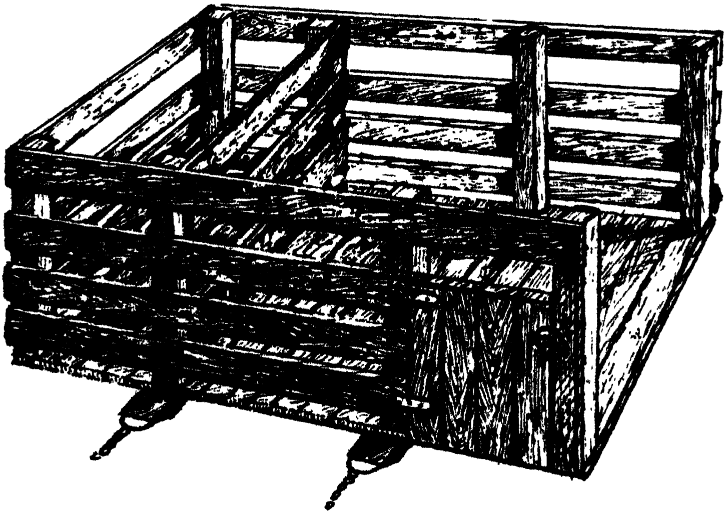

FIG. 6. FARROWING-UNIT: TYPE 4. DETACHABLE FEED AND CONTROL YARD FOR FITTING TO MOVABLE FARROW-HOUSE OF ANY OF THE ABOVE TYPES. TO BE SET IN COW PADDOCK.

No small grass pen attached. Specially recommended for man with two or three sows.
Yard: Detachable on skids with wood floor; same specifications.

DRAINAGE.

In heavy lands good drainage from the sties and yards is a first essential. All fattening-houses should be provided with a narrow, concreted drain to carry all excretions to a sump from which the sewage can be taken and distributed as top-dressing for pastures or carried away by an underground drain to some convenient place. A small catchment sump for the farrowing-pens is also advisable. Sows and litters fed with large quantities of liquid food are likely to make the ground near the house very wet, and to make a wallow of their own urine. This endangers the health of the young pigs. All stagnant waterholes must be regarded as dangerous, because they are infested with germs of disease which are responsible for heavy mortality in pigs of all ages and particularly in young ones.

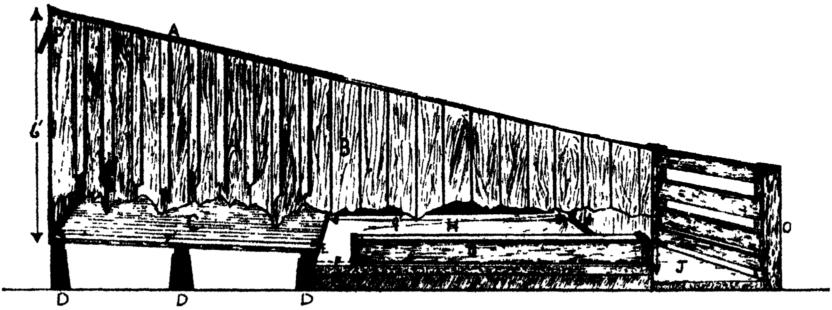

FIG. 7 FATTENING-HOUSE SIDE VIEW

A Roof sarked with roofing felt, and sloping into pen, 8 ft iron

B Close-boarded walls, with slats over cracks as far as sleeping-board close-boarded walls between pens

C Tongued and grooved sleeping-floor with a fall of 1 in. to the foot This appears to be a steep fall, but in practice is ideal

D Concrete or wood piles

E Floor 4 in. above the yard

F Concrete kerbing

G Trough

H Concrete-floor level along wall for the trough, and sloping from house and trough towards door in far corner at the rate of 1 in to the foot.

J Concrete pathway 3 ft wide with drain

O. Fence 3 ft high, making for the easy handling of the pigs

P Louvre, for good ventilation

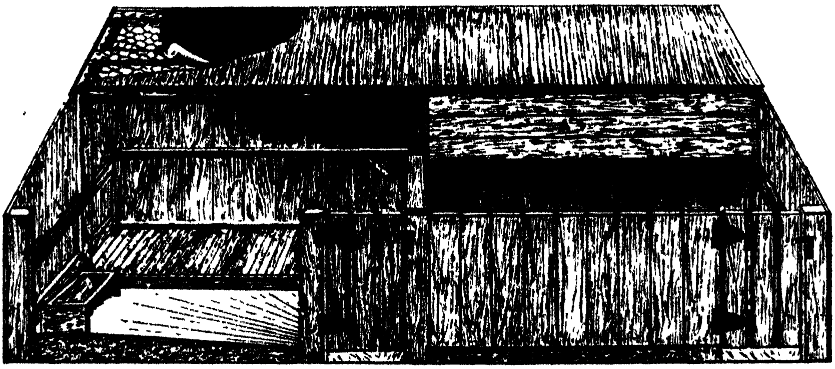

FIG. 8. FATTENING-HOUSE: FRONT VIEW

A Hinged door 1 ft 6 in deep, which can be folded under roof in suitable weather, as shown in adjoining pen.

Shows the construction of interior with trough-level along wall and concrete pen sloping to doorway. The steep fall on house floor and pen make this a simple house to keep clean The roof is shown with netting and felt

NOTE.--The above design and specifications are submitted as suggestions which the farmer can modify and improve to suit his particular conditions.

SHELTER AND SHADE.

A distinct weakness common in pig-keeping is the absence of shelter, for animals of all ages, when not styed, from the ill effects of cold winds or from the heat of the sun. A belt of trees some little distance from the pig enclosures tempers the cold blasts, but

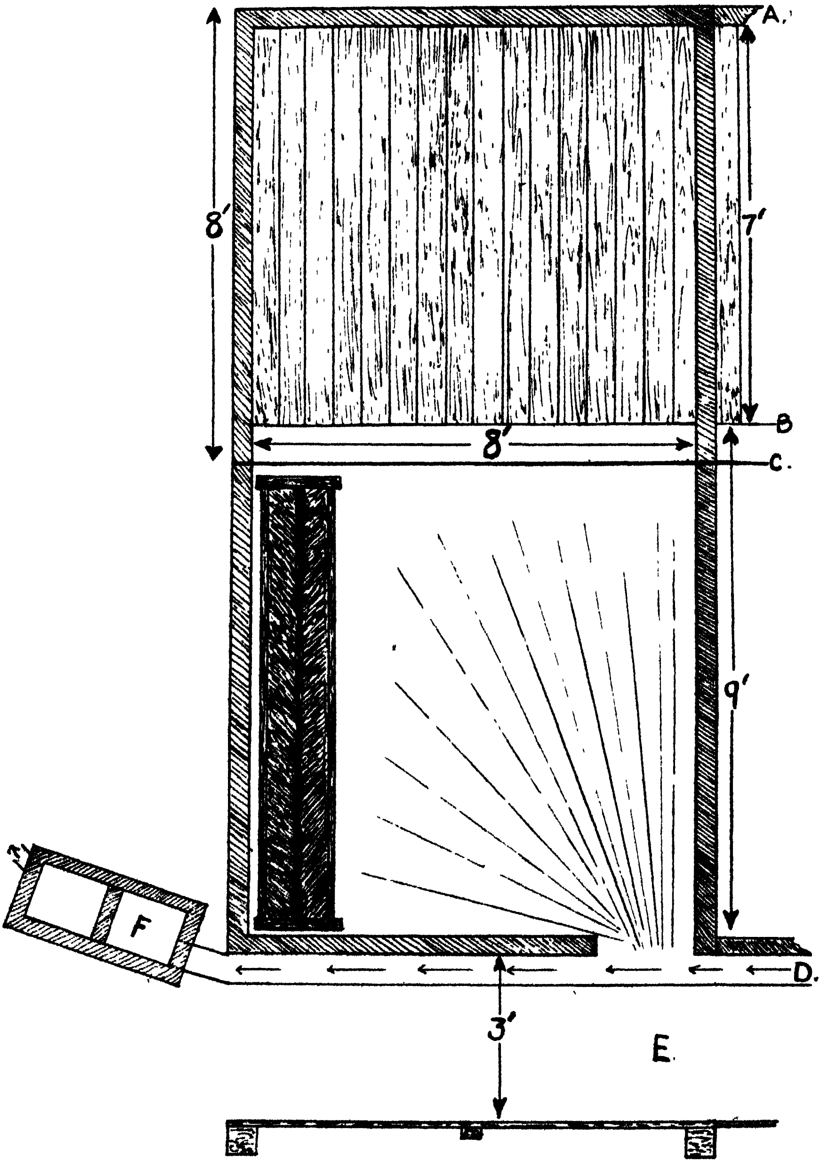

FIG 9. FATTENING-HOUSE: GROUND PLAN.

A to B. Sleeping-floor.
A to C. Roofed over.
D. Drain to sump.
E. Pathway 3 ft. wide (concrete).
F. Sump.

no shelter is so effective for this purpose as a close-bottomed live hedge alongside the boundary and dividing fences of the pens. Any quickly growing hedge-plant is suitable for this purpose if kept well trimmed to ensure dense growth Easily grown plants that have proved efficient are flax, pampas, and toetoe. Any tree such as the weeping willow planted in the enclosures will give shade. Alternately a rough frame resting on posts and covered with straw or branches of trees is very effective, especially when the sides facing the prevailing winds are boarded up. Close observation has shown that the growth and fattening rate of pigs is greatly retarded where they are kept under the paddock system and unprotected from the extremes of weather. Partly because suitable shelter so often is lacking, a recommendation herein is the use of a fattening-house with a small exercise yard attached as a separate unit of the layout along lines which already are giving very good results.

In general, the accompanying plans of the piggery layout and buildings are self-explanatory, and can be adapted to suit a wide range of needs. All outside pens give access to the cow pastures: this allows of extensive grazing, which is regarded as an integral part of economical pig-raising.

As indicated by J on the layout plan, shelter-houses are provided for pigs on cow pastures. These shelter-houses are similar to types 1 and 2, except that they have no fixed feeding-pen or creep. Where only a few sows are kept, these houses can be readily converted into complete farrowing units by using a detachable yard as shown in type 4.

DIGGING, PITTING, AND GRADING SEED-POTATOES.

C. C Leitch, Instructor in Agriculture, Timaru.

INVESTIGATION in this country shows that one of the diseases which probably causes the heaviest loss in potatoes after digging is dry rot. This disease generally has its beginning where potatoes have been injured in the lifting or digging. If the potatoes were not injured this disease would not be able to gain access to the tissues of the tuber, and thus the loss would be avoided. This point is borne out by the fact that when a bag of potatoes is tipped out only those tubers that have been damaged in some manner or other are affected with dry rot. Those with the skin unharmed are generally sound. Damage is likely to occur in digging, pitting, and grading.

Digging can be done either mechanically or by hand. To-day, because of the difficulty experienced in obtaining the services of expert fork diggers, the mechanical digger is mainly used. Of the two methods, it seems that hand digging by experts probably causes the least damage.

The main factors causing damage during hand digging are—(*a*) rough conditions and weed-growth, (*b*) hard-set ground, (*c*) uneven depth of planting, (*d*) uneven spacing. These factors operate also to a certain extent in mechanical digging.

One valuable feature in hand digging is the fact that only one or two tubers at a root are injured, and these are easily noticeable and can be avoided in the bagging-up process.

With the mechanical digger there are several circumstances in addition to those already mentioned where serious injury may occur. If the rows are not correctly spaced it is possible for one wheel of the digger to run along the edge of a row with the result that quite a number of tubers are crushed. Then, again, if the digger is not kept at a sufficient depth the potatoes are sliced. Although both the results mentioned can be avoided if proper care is exercised by the operator of the machine, the proportion of damaged tubers is almost certain to be larger than on a hand-dug area.

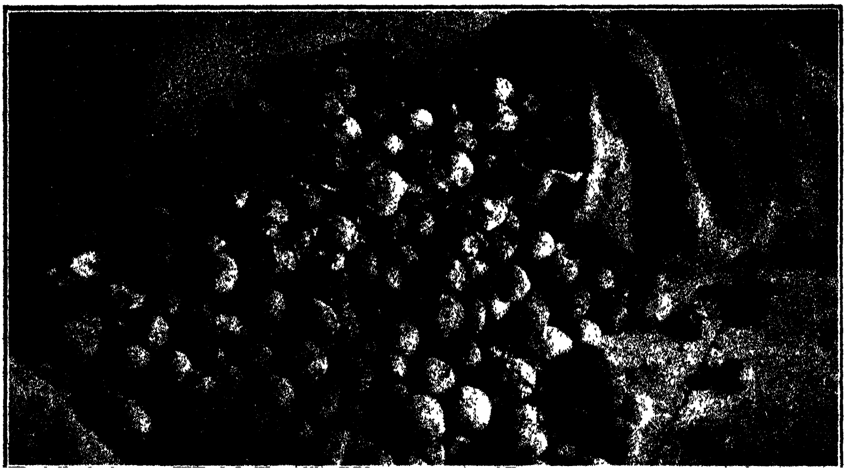

FIG 1. THE RESULTS OF DAMAGE TO THE TUBERS DURING HARVESTING.

The main damage, however, occurs on the "aprons" which convey the dirt and potatoes out of the ground. In order to free the potatoes from the dirt these "aprons" are agitated by means of sprocketed rollers. Most mechanical diggers have a second "apron" similarly agitated. It is here that most of the damage takes place, as, by this time, the potatoes are free from dirt and are being bumped over the bars with no protection. As a consequence bruising is very common, and, although sometimes apparent to the eye, the damage at this stage is not readily noticeable.

Another cause of damage is the digging of the crop before it is properly matured. In this case excessive skinning takes place, thus predisposing the tubers to attack by the dry-rot organism.

In order to minimize the damage caused by mechanical digging some growers take the precaution of putting strips of rubber (old car-tubes) along the two sides, thus breaking the fall and throwing the potatoes more into the centre of the second "apron." Other precautions taken are the removal of the agitator roller and its replacement by a plain roller, and in cases where the earth is dry and the potatoes free from dirt when they reach the top of the first "apron" the second one is removed altogether.

Pitting.—Damage may take place in various ways at pitting, such as—(*a*) rough handling by dumping into the pit; (*b*) allowing moisture to get into the pit by faulty covering and thus increasing the risk of frost injury; (*c*) insufficient ventilation; and (*d*) allowing too much dirt to get into the pit.

Some growers stack their potatoes in sacks, and there is no doubt that this method has much to recommend it. It may be slightly more expensive, but the potatoes are easier to handle, and if any bag is improperly filled it does not get mixed with the rest, and is easily detected.

With the introduction of hay-balers another method has come into vogue, growers using baled straw as the sides of their pits. This makes quite an effective pit, care being necessary to make certain that the covering over the top is proof against all weathers.

Grading.—Grading can be done either by hand or with a mechanical grader. No injury takes places in hand grading, but the process is rather slow. The mechanical grader is a most prolific source of injury. The machine is constructed on the cradle system, and the tubers are sorted into their grades by means of different-sized riddles. These riddles are constructed of corrugated wire which gives a rough surface for the tubers to travel over, and this is certainly the cause of most of the damage The actual operation of the grading-machine is also a matter which requires expert knowledge The riddles must be kept full to avoid excessive bumping. Grading machines, when bought, are "set," but in many cases the angle is not sufficient to ensure the forward movement of the tubers on to the elevator. This arresting of the forward movement causes unnecessary jarring and consequent bruising.

One method which has been tried to obviate this bruising is the substitution of wooden slats for the riddles. These slats, being triangular in their original form, and then rounded on top to prevent bruising on the sharp edges, allow the tubers to drop through without jamming. There are no cross-pieces to cause bumping as in the case of the corrugated-wire riddles.

If a riddle made of rubber or some soft but rigid substance could be introduced, this would minimize the damage to a great extent.

There is one very simple machine in operation which should go a long way towards reducing grading damage. The tubers in this case are hand-graded, but, instead of the grader going to the tubers, the tubers go to the grader on a moving table by means of a shute, the flow of tubers being regulated at the mouth of the shute by means of a rubber band of sufficient elasticity to preserve an even feed. The grader stands on a platform, picks oft the damaged and misshapen tubers as they move along, and also grades into required sizes.

The foregoing is a brief outline of some of the factors which contribute to the injury of tubers during the handling of the crop. If the grower can be made to realize that the matters outlined above are the real source of most of his troubles, and that they must be eliminated before he can expect better results and returns, then a further step will have been taken in the direction of improved seed production.

The following weeds have been declared noxious weeds in Waipawa County: African boxthorn, hemlock, star thistle.

CLOVERS IN PERMANENT PASTURES UNDER CANTERBURY CONDITIONS.

THE RELATIVE PALATABILITY FACTOR.

A. H. Flay, Canterbury Agricultural College, Lincoln.

The medium, light, and poorer soils of Canterbury comprise an area of several million acres. On all these soils the problem of establishing adequate clovers as a component part of newly sown permanent pastures is very real. Some of the factors(1) that assist establishment are spring and early summer sowing, a well-fallowed seed-bed free from weeds and well consolidated, and the use of adequate lime and superphosphate. Early grazing-management so that the new pasture is not eaten short or allowed to get out of hand is also of value. The relative palatability of the species that make up the sward and the need for spelling or very light grazing at certain times to allow development of the lesser or more readily eaten constituents in the sward, however, has not received sufficient consideration.

In the past when almost every Canterbury farmer was sowing temporary rye-grass and attempting to secure a permanent pasture from it he generally grew satisfactory clovers, especially in the second and third years of the life of the sward. Red clover, and sometimes alsike and white clover, were sown in these pasture seed-mixtures. These pastures were of high quality for one, two, or three years. In the first year sheep thrived well and fattened on the relatively more palatable false perennial rye-grass in the sward. This rye-grass, in consequence, was grazed more severely than the clovers, with the result that the clovers made a good development into the second year, and sometimes into the third, by which time they usually contributed the bulk of the grazing. The red clover generally commenced to weaken in the second and third year, and then it would be grazed harder than the invading and less palatable hair-grass, sweet vernal, brown-top, &c., and consequently would soon die out. Ordinary or stubble white clover very largely shared the same fate as the red clover.

Recently, permanent perennial rye-grass of relatively lower palatability than the temporary type has been sown in the grass seed-mixtures by most farmers. This permanent rye-grass appears to be less palatable than the clovers sown with it. Further, it is much more persistent, with the result that the clovers have less opportunity to develop, especially in the first and second years of the life of the sward. Because of this palatability factor, the clovers in this permanent rye-grass sward are eaten first in preference to the rye-grass. Whilst stock (sheep) are being kept on the area to eat down the rye-grass, the consequent hard grazing of the clovers soon reduces their vigour, with the result that at the end of the first year in the life of the new pasture there are few clovers. As well as hard grazing, dry weather, in recent seasons, has assisted in reducing the clover content of many pastures.

It is commonly believed that true perennial rye-grass must be kept grazed moderately bare to secure the highest carrying-capacity and to obtain the best sward. Although this may be true on heavy land and in districts of high rainfall where heavy top-dressing is practised, it does not hold for Canterbury's poorer and lighter soils.

Assuming a spring, summer, or early autumn sowing, a new pasture may be grazed in the usual rational fashion until toward the end of October. This implies that the newly establishing sward is never kept grazed even moderately short for any length of time. By October or early November the rye-grass begins to shoot to seed, and, on all soils except the best, it becomes tough, hard, and distinctly unpalatable compared with the succulent clovers in the sward. By November, also, if not earlier, the accumulated fertility built up during the fallow prior to sowing has probably been used up, with the result that the rye-grass, which at first grew rapidly, providing reasonably luscious, palatable feed, now grows much more slowly. Slowly growing true perennial rye-grass under low-fertility conditions is distinctly unattractive to stock.

Under Canterbury conditions, then, with the soil also probably becoming steadily drier as the summer is approached, everything favours a slowly growing, stalky, hard, and tough unpalatable true perennial rye-grass. The lower the fertility the more pronounced is this development. It is at this stage that attempts are often made to graze the rye-grass closely " *to control it*," whereas the best treatment the rye-grass could receive would be little or no grazing at all, so that the clovers would not be severely treated and perhaps killed by the hard grazing before they are properly established. Without clover development there is little chance of securing an improved growth in the rye-grass. The statement(2) " without white clover rye-grass won't grow " is very true for the medium, light, and poorer soils of Canterbury.

The grazing-management, then, during November, December, and January on the newly establishing permanent pasture should consist of no grazing at all if clover-growth is poor, or a very light grazing so that a good clover-growth takes place Often a two-month period of such special treatment is sufficient. This spelling should not be such that lodging of clovers takes place, and on the better soils it would consist of light grazing rather than entire spelling. The poorer the soil the greater the need for clover development, and hence on poor soils spelling for at least two months is practically essential. It is an advantage to have 6 in. to 12 in. of ordinary or Montgomeryshire red-clover growth for lamb or other feed in January or February: white clover is given a chance to fill out and develop, and subterranean clover is allowed to seed profusely in its first season.

It is true the rye-grass will run to seed during the light grazing or spelling stage. This is no disadvantage as far as has been observed over a period of several seasons in Canterbury. Often light hay crops of rye-grass and clover have been saved, rye-grass seed where the clovers have been poor has been reaped, and where clover-growth has been good such stands have been mown and header-harvested. More frequently on poorer soils the clover-growth has been used for feed in January and February for lamb-fattening, &c.

A sward consisting of ordinary or Montgomeryshire red clover, certified white clover, and subterranean clover, along with true perennial rye-grass and cocksfoot, properly sown, top-dressed, and given the grazing treatment discussed above, not only produces for a greater number of years and gives a higher carrying-capacity, but also provides a much more palatable and luscious true perennial rye-grass than a pasture in which clovers are not allowed to develop. With this grazing treatment for a year or two and its consequent improved clover-growth the palatability problem sinks into the background.

Without clover development true perennial rye-grass may be condemned as not being a high-quality feed. With poor or no clover-development on the medium and poorer soils, it takes three or four years for true perennial rye-grass to pass through the weak, pale, tough, and distinctly unpalatable stage. By this time the invasion from and development of inferior species may be such that they are the dominant species in the sward.

Under Canterbury conditions grazing should be such that pastures are spelled periodically to allow clover development. In the first year of the life of the pasture this is imperative. It is very hard, close grazing that allows the sheep to eat out the relatively more palatable clovers often before they are established and in preference to the relatively less palatable true perennial rye-grass.

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Variety.	Grower.	Acreage.
Cross 7	Bell, J. R., Morven	40
	Callaghan, J. A., Methven	20
	Canterbury Seed Co., Leeston (Line C)	24
	Corbett, E., Waikakahi Road, Waimate (Line C)	18
	Dore, W. J., Fairlie	20
	Evans, H., Masterton	8
	Hampton, J., Lauriston	33
	Hill, H., Geraldine	8
	McCaw, W. T., Tycho R.D., Timaru (Line B)	10
	Parnham, T. R., Whiterock, Rangiora R.D.	11
	Relling, H., Tycho, Timaru	15
	Stevens, E. H., Anama, Ashburton	15
	Talbot, P. R., Claremont, Timaru (Line B)	8
	Wells, T. M., Rakaia	12
Dreadnought	Henshaw, F. J., Studholme Junction	10
	Sansom, J., Section 4, Kormacks	6
Hunters II	Gibson, A., Tycho Timaru (Line A)	9
	Gibson, A., Tycho Timaru (Line B)	6
	Kavanagh, Mrs., Ryans Road, Upper Riccarton	10
	Murphy, R. J., Pleasant Point	27
	Robinson, R. P., Waikuku	16
	Ryan, E. P., Sutherlands	23
Solid Straw Tuscan	Canterbury Seed Co., Leeston	15
	Catherwood Estate, Springbank, Rangiora R.D.	54
	Coup, R. A., St. Andrews	12
	Hunter-Weston, R. P., Albury	12
	Lyon, C. R., Temuka	5
	McHugh, P., Estate of, Darfield (Line A)	30
	McHugh, P., Estate of, Darfield (Line B)	10
	White, G. T., Waiau	18
	Wilkinson, V., Mitcham	6

—*Fields Division.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 11th March, 1937, to 22nd April, 1937, include the following of agricultural interest:—

No. 77282: Hay-sweep attachment; J. McL. Davidson and O. Omundsen. No. 77304: Tractor; H. G. Ferguson. No. 75011: Egg-packer; F. Francis. No. 75430: Treating seed; G. E. Heyl. No. 75612: Citric soluble phosphate; G. Arkinstall. No. 76012: Centrifugal cream-separator. No. 76070: Releaser flap; R. McIntyre. No. 77309: Flame-producing apparatus. The Eclipse Spraying Co., Ltd., and W. Grimley. No. 77417: Egg-cooker; J. Ewart. No. 76072: Teat-cup; J. Treloar. No. 76131: Switch for meat-rails; Auckland Farmers' Freezing Co., Ltd. No. 76791: Bracken-destroyer; V. H. Holt. No. 76361: Concrete fencing-post; H. S. Waters. No. 77072: Mower; W. Aston.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid.

SEASONAL NOTES.

THE FARM.

The Pastures.

On most farms there are one or more grass paddocks which are more suitable than the majority of the paddocks for providing late winter and early spring feed, especially if they are suitably managed. As a rule these are the paddocks which are well drained, which carry pastures containing a good deal of rye-grass, and which possibly are provided with some shelter. Such paddocks in particular should be harrowed if droppings have accumulated, top-dressed in good time, and grazed leniently rather than closely at this stage If, after such treatment, they are shut up in May or early in June, then in all but the more severe districts they may be expected to provide a substantial amount of feed in the latter part of July and in August.

If at this season dead pasture vegetation provides evidence of infestation by the grass-grub, then, when possible, feeding out of hay, silage, and roots should be concentrated on the infested areas unless these are in fields which are to be put under the plough in the immediate future. The use in this connection of hay saved at too mature a stage of growth may supply considerable numbers of viable seeds of valuable pasture species, and these seeds, on germinating, tend to repair the damage done by the grubs. Further, the additional stock trampling and consolidation of the land which results from feeding-out either lessens the activities of the grubs or assists in the recovery of any injured plants by favouring root renewal.

Apart from the paddocks specially treated for the production of early feed as already discussed, farmers should now proceed as rapidly as possible with any harrowing and top-dressing that remain to be done before the arrival of the dormant season of grassland. Manures applied when the soil is so cold that grass-growth has practically ceased have little or no effect until greater soil warmth returns. Just when it is too cold to apply manures effectively is controlled largely by geographical position, though such circumstances as drainage and aspect affect the matter , in the coastal districts fertilizers as a rule may be applied with good effect later than in cooler inland situations, and later generally in the North Island than in the South Island. Although top-dressing should be carried out before the advent of the most inactive period of growth if this is at all possible, it sometimes may be advisable to top-dress during the " dead " period of pastures as an alternative to the inconvenience and, possibly, inefficiency arising from a heavy rush of work in the spring. Phosphatic manures applied in the dormant period as a rule exert their influence as soon as the warmth necessary for growth returns ; it is considered that normally their effect is merely delayed and not lost—wide observations in the field support this view. The same position is believed to hold in general relative to both lime and potash. But it is radically different with soluble nitrogenous manures such as sulphate of ammonia : if conditions unfavourable for growth prevail for any considerable period after the application of such manures, their influence, judging from fairly extensive field experience, is considerably lessened.

Phosphates hold the key position in New Zealand top-dressing : the first and principal necessity is generally the application of phosphates, and so phosphates as a rule may be expected to give the greatest and most immediate profits. There are exceptions to this rule, but a farmer should make sure his case really is an exception before ignoring the rule in his practice. An exception may be expected when, on all but the richest soils, a visible benefit from phosphates is not evident : trial applications of both lime and potash are highly advisable when distinctly visible results from phosphates are not obtained on soils of medium to poor quality in districts with an average rainfall of 25 in. to 30 in or more Incidentally, whether distinctly visible results are also profitable results is dependent largely upon the composition of the sward : a distinctly visible benefit in a pasture composed mainly of weeds and inferior pasture-plants may also be a distinctly unprofitable result, but, nevertheless, it may be of value as an indication of potential profit from top-dressing to be realized when the composition of the sward is suitably improved

Crop Utilization.

Generally it is highly inadvisable to allow " wet " and growing young stock to fall off much in condition before a commencement is made with the feeding of reserves of such materials as hay, roots, and silage

The winter feeding of stock on roots alone is undesirable Stock so fed receive a diet which is much too watery and cold, and which is likely to lead to digestive disorders Heavy root feeding is especially unsuitable for old toothless ewes if the roots are offered intact, while to any class of breeding-ewes and to dairy cattle it is inadvisable To secure the best results from roots they should be fed with some dry feed such as hay or chaff

Misconception about the feeding-value of silage seems to be common The misconception generally arises from attributing a nutritive value to silage greater than actually characterizes it, with the result that stock which are considered to be fed adequately are really being semi-starved The true position may be deduced from the fact that the ensiling process is merely preservative in its effect, and does not lead to an improvement in the nutritive value of the material being ensiled in fact, it leads to a falling-off in nutritive value Guidance on the feeding of silage is to be found in the following facts. 1 lb. of typical grass silage equals in feeding-value approximately 2 lb roots, 1 lb. of good average hay is equal in feeding-value to 2 lb to 2½ lb of grass silage. 1 lb of silage is of somewhat lower feeding-value than 1 lb. of the green herbage from which the silage is made It is inadvisable as a rule to feed animals on silage alone : silage should be used to supplement pasture just as hay and roots ordinarily are used for that purpose Under New Zealand conditions it should seldom be necessary to feed to dairy cows more than 40 lb each daily usually smaller amounts suffice in conjunction with the feed provided by the pastures As a supplement to pastures silage has been fed with profitable results to sheep at the rate of about 2 lb a head daily Silage as ordinarily made in New Zealand is far too fibrous or stemmy for satisfactory results from feeding to pigs, which differ physiologically from sheep and cattle in a way which necessitates less fibre in the feed of pigs if good results are to be assured.

In many cases the pulling and storing of mangels should be done in June, especially if the land occupied by the mangel is required for another crop such as oats, which should be sown soon, or if the land is likely to become so wet later as to make handling of the crop difficult But general rules about the time of pulling mangels tend to be unreliable : the position varies somewhat in different districts and seasons Crops may continue to grow in weight well beyond the date fixed arbitrarily by some as that at which pulling should be carried out. It is doubtful whether it is generally advisable to pull such crops early in June if they are not to be used until late August or September However, if the crop is to be fed to stock earlier than the time mentioned, then it should be pulled in good time to allow it to ripen or mature before it is eaten by the stock. Freshly pulled mangels are more subject to frost injury than those still in the ground or those that have been pulled for a few days Hence, in order to avoid frost injury, an endeavour should be made to select a period of broken mild weather for the task of pulling. Many sheep-farmers successfully utilize mangels without storing them. Customarily, after the leaves have been eaten off by broken-mouthed sheep the roots are harrowed out in breaks some days before other sheep are given access to them. This takes place usually somewhat late in the season, when the mangels before being dislodged have already undergone a considerable amount of natural ripening.

General Work with Arable Crops.

When the soil is not distinctly wet and cold, oats and barley may sometimes be sown with success in June to provide valuable spring feed. Such crops should not be drilled deeply, and usually respond profitably to a dressing of about 1 cwt. an acre of superphosphate. Seed treatment for the control of certain common diseases should not be omitted.

Heavier yields than those commonly obtained of mangels, chou moellier, rape, and potatoes generally would be more profitable after making due allowance for the extra expenditure or effort needed to secure the heavier yields. This is due to the fact that as a rule the main heavy items of cost have to be met whether the crop is merely a medium one or a really heavy one. For instance, the costs of land, of seed, of some manure, of ploughing, harrowing, disking, drilling are the same for a 30-ton crop as for a 60-ton-an-acre crop of mangels.

One of the main factors limiting crop-yields is insufficient tillage especially before, but also after, the sowing of the seed. Under many circumstances it would be advantageous to begin at this season the preparatory cultivation for the crops already mentioned. When land carrying old pasture is to be used for such crops usually the first steps should be skim-ploughing, followed by disking to pulverize the soil, which later should be turned down deeply by a full ploughing, and then left undisturbed by the subsequent surface tillage needed to get a fine seed-bed The original surface layer of an old pasture is likely to be heavily infested with weeds and weed-seeds, and in order to place this layer well underground where they will give the minimum of trouble it is sometimes of value to use on the plough a suitable skimmer-attachment which facilitates the complete burying of the surface layer and thereby lessens the development of weeds between the furrows.

Drainage.

Much poorly drained land in New Zealand would give profitable returns immediately from expenditure on suitable drainage. Especially in arable farming, drainage of isolated relatively small wet areas often is a most profitable improvement which does not call for considerable outlay. When tile drains are used in the drainage of isolated wet spots the lines of drains should be located so that they would serve of part, and possibly as the basis, of any more comprehensive future work.

Money may easily be wasted on drainage, even in the case of land very poorly drained, unless the work is properly planned and carefully carried out. Considerable information about practical aspects of drainage is available from district officers of the Fields Division of the Department of Agriculture.

Occasionally drainage is not practicable; then the employment of useful plants which tolerate poorly drained conditions should be considered. Fortunately there is available a fairly wide range of such plants which vary substantially in the degree of wetness which they will tolerate. *Glyceria fluitans*, *Poa aquatica*, and strawberry clover, for instance, prove useful on land which may be immersed for prolonged periods each year, while meadow foxtail, *Poa trivialis*, and *Lotus major*, though not suitable for such land, are useful for land which is far too poorly drained to provide a satisfactory habitat for rye-grass, white clover, or cocksfoot.

Ensilage Work.

Pits and trenches are economical for ensilage—firstly, because they lessen the wastage of material in comparison with the stack system of ensilage, and, secondly, because they make the work less laborious. Further, satisfactory pits and trenches can be provided at very little cost, and while many farms may not have suitable sites for pits, the farms on which there are not suitable sites for trenches are not at all numerous The provision of suitable pits and trenches often conveniently may be given attention during the relatively slack winter period. It is a distinct disadvantage to have only one pit or trench on a farm in that it necessitates either the transport of the heavy green material considerable distances at times or the saving of silage from certain handy fields so frequently that deterioration of their swards cannot but take place. As a means of avoiding the need of choosing between these undesirable alternatives some progressive farmers provide a number of pits or trenches not all of which are used every year. This excellent practice has the additional advantage of facilitating the creation of greater reserves of feed than the customary ones which are inadequate provision for any prolonged period of low production of feed such as occurs when an unfavourable summer follows a severe winter.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Cultivation.

PLOUGHING, if not already commenced, should be put in hand at once so that the soil may be turned over and exposed to the beneficial action of the winter rains and frost. It is advisable to plough to the trees, leaving an open furrow along the centre of the lands between the rows of trees so that any water collecting in the open furrows may be as far away as possible from the main roots of the trees. Always plough with the fall of the land to assist in the drainage of surplus water.

Manures and Fertilizers.

Where required, carbonate of lime may be applied to the soil at the rate of 1 ton per acre, after the ploughing is finished. During the winter months manures such as superphosphate at the rate of 3 cwt. per acre and muriate of potash 3 cwt. per acre should be applied just prior to this the deepest ploughing of the year, where such fertilizers are required, as they are not readily washed out of the soil, and will be available to the tree-roots in the spring.

Cover-crops, in suitable districts, should be just coming into flower, which is the correct time to turn them under, as before this stage of their growth the legumes have not sufficient nitrogen for the trees to derive the maximum amount of benefit.

Pruning.

No trees call for more skilful treatment than do the peach and nectarine, owing to the need for maintaining a supply of fresh wood and spurs on lateral growth. The peach and nectarine bear only on the past season's wood-growth, and care must always be given to the proper feeding and cultivation, so as to ensure adequate growth

These trees come into bearing at a very early age, frequently in the third year after planting. It is wise to form a low, stocky tree, with a strong, open framework to carry the crop, obtaining a wide, open base, and an open head with plenty of space in the centre and between each of the leaders.

Some pruners practise far too open a system of pruning. This should not be overdone, for it leads to sun-scald and consequent checking of the sap-flow. Once the full number of leaders has been obtained, the leaders should be maintained intact, without branching, in the same manner as obtains with the apple and all other deciduous trees. The leaders should be pruned in such a manner as will maintain their position in the tree, otherwise the buds on the terminal growth develop into fruit-buds, and the lower fruit-bearing wood starve and ultimately die. By pruning hard and feeding well the tree can be kept in good bearing from base to top for twenty or more years. By hard pruning and by keeping the tree reasonably open (for it must be remembered that peaches and nectarines are heavy-foliaged trees and will not stand crowding) the fruiting-laterals along the main and sub-arms can be kept healthy and productive, by a constant renewal of growth, but if light and air are shut out by overcrowding of the top, the lower fruiting-wood soon becomes exhausted and starved, and bare, barren limbs are the result.

The points of the leaders should be cleared of competing shoots, but the small lateral growth of the past season immediately below the tips should not be removed. This has the effect of checking the sap-flow slightly, causes the buds below to throw out fruiting-laterals, and in this manner the buds are developed farther back on the leaders, the tree is well furnished throughout with laterals, and no extended portions of bare wood result, such as is often seen on peaches and nectarines

In pruning for fruit, short, woolly-budded laterals may be left unpruned where not too crowded Weak spurs should be shortened back to the two wood-buds near the base Where there is too much fruiting and weak wood it is necessary to remove some of it altogether, but always bear in mind that fruiting-wood will be required for next season, as the peach and nectarine bear only on the past season's growth.

Some of the spurs die each year, and others become exhausted or too long, and these must be replaced, or long bare limbs result. It is a good plan to always leave fruit-buds in excess of requirements, because less than one-half of the flowers set fruit. The best fruit-laterals are on the strong shoots carrying a series of two flower-buds with a wood-bud in between. These should be shortened back so as to leave only four to eight of these cluster fruiting-buds according to the carrying-capacity of the tree

The early varieties of peaches have the habit of dropping their flower-buds just as the sap rises. This occurrence is very prevalent in some portions of the Dominion. It can be overcome only by intense cultivation. The nipping of the latest shoots during the summer, or pruning them immediately the fruit is harvested, is advised. This would have the effect of strengthening the buds. The alternative is to leave the pruning until the "pink" stage of the blossom, for the buds which remain up to that stage do not fall, and there is no risk of cutting off the fruit when pruning. Then shorten back those laterals which show an excess of blossom, leaving others entirely alone and shortening others to wood-buds: in order to "throw" fruiting-wood to carry the following season's crop, constant renewal of growth must be maintained.

The apricot should be pruned with a short main stem, 12 in. to 15 in. high, and very sturdy, wide main and secondary arms. Owing to its brittle nature apricot wood is very liable to split. Narrow forks should therefore be avoided, and also because they are more liable than wide forks are to gumming. The main arms should be well spaced, and started as for other classes of trees. If well cared for the tree is a strong, wild grower, and for the first four years it should be both summer- and winter-pruned—pruning the leaders and thinning them as well as the lateral growth. The early summer treatment is advisable only when the trees are strong and vigorous, but the lateral growth may be treated during every summer up to the fourth or fifth year. Summer pruning should not as a rule be practised after the tree has settled into good bearing habits and the wood-growth has steadied.

Summer-pruning hastens the building-up of the tree, as well as helping to form a sturdy, strong tree, and to check the natural tendency of the apricot when young to grow wild and rampant.

Both the summer and the winter prunings should be fairly hard for the first three or four years, after which the leaders should be left longer. The tree is naturally prolific and early in its bearing, if planted in suitable soil and situation, and, well cared for, will bear a good crop in its fourth year. It throws out short laterals, which are the fruiting-spurs, all round the main and secondary arms, and light and air circulation are well provided by the wide system of pruning which ensures the full ripening and development of the fruiting-wood. By "heading-off" during early summer the required number of leaders are quickly obtained, and it is not then desirable to have any further forks or branching. The summer pruning will develop plenty of fruiting-laterals, but after the discontinuance of summer treatment the leaders should, in the winter pruning, be headed just above the cluster of small lateral growth usually to be found about half-way up the last season's growth. This causes the sap to be checked slightly, resulting in the buds below the cluster throwing out light laterals With proper attention to this point no bare wood will result along the leaders. As the top growth ceases the pruning should become much more severe, because it is then necessary to prune the leaders hard to encourage top growth, and the clusters referred to are not required for checking the sap-flow. When pruning for fruiting-wood every care must be given to the thinning and shortening-in of the longer laterals to from four to six buds, cutting just beyond fruit-buds and to a wood-bud, otherwise the tree is liable to overbear and produce small unmarketable fruit , and, apart from this, the spurs will be too long The short laterals are best left alone until after bearing, when they should be cut back gradually, as they begin to branch "Water-shoots," unless needed to fill a space caused by the breaking or removal of a limb, are best removed flush with the limb , but in the case of old trees not too well clothed with fruiting-wood on the main and secondary arms, the "water-shoots" should be retained and fully utilized by constant cutting or nipping back during the summer, before they get too strong and too long. By this means good fruiting-wood can be produced along bare limbs, to replace that which has been lost If left alone, "water shoots" will take an undue amount of the sap and rob the rest of the limbs.

Prunes and plums which make strong growth should be both summer- and winter-pruned up to the fourth year, in the same manner as for apricots—that is, both laterals and leaders should be pruned during the summer.

Start the trees, as in other varieties of deciduous fruits, with low stem and open sturdy main and secondary arms and hollow centre, and prune regularly every winter and summer if the growth is strong, obtaining a nice shapely tree. The small growth round the base and up the main arms should not be removed, but should be lightly pruned each season. This shelters the main arms and trunk, and later on the small growth bears fine crops of fruit, which ripens later than the fruit above, and extends the harvesting-period.

Most varieties of cherries are upright growers, and every effort must be made to spread the tree during the first few years and to obtain a sufficient number of leaders. For the first three years prune very judiciously and spread the tree well, obtaining as wide forks as possible, as narrow forks gum badly. Pruning should be carried out in the spring time when the sap is rising (when the buds are commencing to burst), as this assists in the prevention of gumming in cherries.

It is best to obtain as many leaders as are required during the first three or four years, for after this period it is advisable not to prune so severely, but to confine one's attention to removing any cross-limbs or branches and shortening-in any long laterals. The leaders should, however, be cut back slightly to a single bud, to keep them sufficiently stiff to prevent them from bending down to a harmful degree. Leaf-spurs, if not pruned, usually develop into fruit-spurs, which is usually the culmination of another season's activities. Many leaf-spurs are, however, removed with the shortening of old leaf twigs. The acquirement of fruit-spurs should be the aim of the pruner. Consequently, when attained, no pruning is applied to the individual spur until such time as the accumulated extension of many seasons result in an attenuated and gnarled condition being reached, when the sap circulates too sluggishly to induce the development of an ample supply of strong flower-buds. When signs of this condition are detected the spur should be cut back to a subdivision, if present, near to the parent limb. If such is not available, nothing but the complete suppression of the old spur is recommended, when possibly dormant base-buds may be started into activity to replace the old spur.

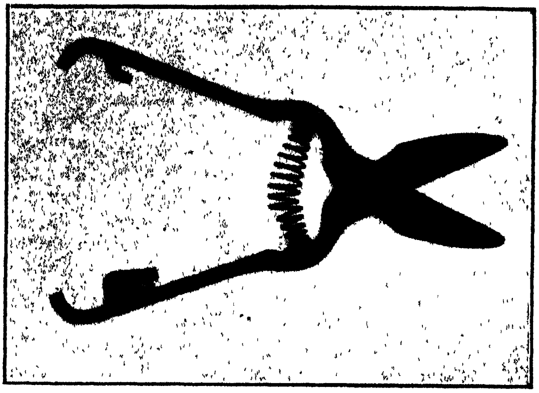
All big cuts (which should be made in summer only) should be painted over with a bitumen emulsion, or with white or red lead.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus Culture.

Harvesting.—During the coming few months more of the main crop of lemons reach the approved size for picking. By this is meant that they become of sufficient diameter to pack out after curing, counts ranging from 180 to 234 to the standard bushel case. These are the sizes which are preferred by the buyer, and for which he will give the highest price. The 216 count probably is his first choice. As with other kinds of fruit, it is important that the producer of citrus fruit, as far as is practicable, supply the buyer with a product which meets the requirements of the trade. Preferred sizes generally return from 1s. to 1s. 6d. per case more than the larger counts, with even a greater difference against the very small fruits. There are some who hold that it pays the grower to produce the 162 and 150 sizes even at the above-mentioned discount, as more boxes can be filled with the same number of fruit, and that the cost of picking, wrapping, and packing per box is less. In regard to this it should be remembered that lemon-trees are bearing almost continuously, and picking should be kept up to date in order to maintain vigour and growth in the smaller fruit formed more recently. Additionally, most pickers do not secure complete accuracy in picking for size, and there are always some fruit under or over the standard. Hence, if a larger lemon is taken as the standard in picking, a greater percentage will be too large for inclusion in the standard "extra fancy" and "fancy" grades. Then, again, if a buyer is not obtaining his quota of preferred sizes from the usual sources of supply he may be forced to look elsewhere for his supply. There is evidence that the housewife prefers a larger lemon than she is now being supplied with from the stores, but until the method of marketing and distribution is altered it appears to be advisable for growers to pay strict attention to supplying the buyers with the sizes which they require.

Owing to the shrinkage which takes place during curing, lemons have to be picked approximately ⅛ in. larger in diameter than the size required for a cured lemon. Unless definitely skilled at size-selection, the picker should carry, when at work, one of the light metal size rings which may be obtained from any of the citrus-packing sheds or orchardists' supply organizations. Any lemon which goes through the ring, which is 2⅛ in. in diameter, is not yet up to size for picking. There is an exception to this rule, and that is in the case of lemons which through some cause, such as lack of vigour in the tree or frost injury, become tree-ripe. Such fruits should be picked forthwith. However, in a well-managed grove one does not expect to find many of this type of lemon at this time of the year. It is possible also to have lemons which are up to size but which are too immature for picking. These fruits do not colour or cure satisfactorily. They are few in number, however, and one can detect them only after practical experience. Picking is done by means of special clippers, the blades of which are slightly curved and rounded at the "nose."



Two cuts are generally required to pick a lemon, the first severs the fruit from the tree with stalk or twig still attached, and the second cut trims off this stalk level with the button. The leaving of sharp stubs is a very prolific source of damage to fruit by skin-punctures, with subsequent loss by blue and green mould. It is very important that those in charge of picking-gangs spend time in checking this point, the most suitable opportunity for this occurring when pickers are emptying their bags into the orchard boxes. At the same time observation can be made as to the care with which the fruit is placed in the cases. It has been claimed that a fall which breaks an egg injures a lemon or an orange. Orchard boxes should be filled properly, but on no account should fruit project above the sides so that when stacked injury occurs. Investigations reveal that these small points, together with those enumerated in February notes under the heading "Picking," are the causes of mould gaining an entrance to the tissues and the subsequent loss which occurs. The mere fact that each matter appears to be comparatively trivial often causes its neglect, but until sufficient attention is paid to these details by practically every grower the industry must continue to suffer.

The rule of picking according to size irrespective of colour does not apply to New Zealand grapefruit and sweet oranges. For dessert purposes these should be left on until they are tree-ripe, when they should have acquired both flavour and good typical colour. Grapefruit is becoming popular as a breakfast food, and is used in a manner similar to that in which the American type is used overseas. The possibilities of increasing local sales of the New Zealand product are great indeed, but, unfortunately, much of the fruit is still being marketed in too immature a condition. Unless this fruit is tree-ripened it certainly will fail to be more in demand. This would be most unfortunate, and can be avoided if care is taken not to harvest the fruit before it has become palatable. Even for marmalade the specifications of the large jam-manufacturing concerns indicate that they do not desire the green fruit, but prefer the more mature, well-coloured article. No doubt there is a certain domestic demand the meeting of which causes growers to harvest immature fruit against their better judgment. When this cannot be avoided the practice already adopted by some packing sheds of distinctly labelling the cases with an indication that the fruit is for marmalade-making only should be followed.

Disease Control.—The principal winter disease of citrus is brown-rot. To prevent infection all parts—fruit, foliage, and wood—should be protected with a covering of Bordeaux 3-4-50, to which has been added summer-oil 1-100 as a wetting-agent. This matter was dealt with last month, but is repeated now, as the danger period extends right through the winter. Growers often assume that because they quite plainly can see traces of Bordeaux on the trees these are sufficiently protected, even although the application was made several weeks previously. According to research workers, the visible deposit after this interval is merely lime, which is generally in excess in all Bordeaux mixtures: the fungicidal value has all been expended. Apart from this, relative to maintaining coverage, the fruit is growing rapidly and making new tissue which has not yet been sprayed, while the same often may be said of the foliage. In some instances growers consider that their autumn application for the prevention of verrucosis serves as a brown-rot spray as well, while others think that the May application for brown-rot is in time to protect the autumn setting of fruit from verrucosis. These growers fail to control one disease or the other or both. When certain diseases, such as verrucosis, do not occur, spray programmes may be modified accordingly.

In some districts leaf-roller caterpillar is in evidence, and, apart from the damage this pest does to foliage, on young trees as well as on old, it also bores into the fruit and causes premature dropping and decay. Where it is known to be present, arsenate or lead powder 1½ lb. to 100 gallons should be added to the Bordeaux mixture. The leaf-roller caterpillar is much more prevalent on oranges than on lemons.

Grading Standards.—It appears necessary once more to draw the attention of growers and curing-shed managers to the provisions of the lemon-grading regulations, particularly to section two, which reads as follows:—

"Lemons for inclusion in any grade shall have a minimum juice content of not less than 25 per cent. by volume. For the purposes of this clause the juice content of lemons by volume shall be determined as follows: The fruit volume of a representative sample of not less than twelve lemons shall be measured by water displacement. The quantity of juice contained in the fruit shall then be extracted by reaming or by other approved means; then screened by pressing through cheese-cloth, and its volume measured. The percentage of juice by volume shall be ascertained by dividing the measure of the juice volume by the measure of the fruit juice volume and multiplying the result by 100."

—*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

Census of Poultry, 1936.

THE following is the principal result of the census of poultry which was associated with the census of population taken for 24th March, 1936, as compiled by the Census and Statistics Department, and published in the *Monthly Abstract of Statistics*, February, 1937. The figures relate to both male and female birds:—

	North Island.	South Island.	Total.
Fowls	1,939,581	1,548,935	3,488,516
Ducks	271,187	106,604	377,791
Geese	36,550	30,117	66,667
Turkeys	68,740	17,362	86,102
Total poultry	2,316,058	1,703,018	4,019,076

The proportion of poultry to population is higher in the South Island than in the North Island by about one-third. The above figures include poultry maintained by Maori households, amounting to 107,361 birds, in 7,256 flocks. This is believed to be the first occasion on which data regarding Maori poultry flocks have ever been compiled. The smallness of the figures now disclosed shows that the omission of past years was unimportant. Per head of Maori population aggregate Maori flocks give an average of only 1·3 birds: a similar figure for the European community gives 2·6 birds.

Movement in the numbers of poultry over the last six censuses has been—

Census.	Fowls.	Ducks.	Geese.	Turkeys.	Total Poultry.
1906	2,784,269	281,999	44,300	77,101	3,187,669
1911	3,215,031	329,230	45,389	97,933	3,687,583
1916*	3,141,354	220,808	46,955	56,521	3,465,638
1921	3,491,567	379,988	46,234	73,220	3,991,009
1926	3,308,384	352,030	43,879	76,852	3,781,145
1936 (excluding Maori flocks)	3,415,793	351,608	61,418	82,896	3,911,715
1936 (including Maori flocks)	3,488,516	377,791	66,667	86,102	4,019,076

* Census taken in spring; all other censuses in autumn.

The ten years, 1926–36, increase in the poultry totals was only 130,570, or 3·5 per cent. of the 1926 level. Since 1911 the numbers of poultry have not kept pace with the growth of population. The average number of birds per head of population has been as follows (Maori flocks are not included) :—

1906	3·6	1921	3·3
1911	3·7	1926	2·8
1916 (spring)	3·2	1936	2·6

The number of households maintaining poultry numbered 166,354, or 159,098 if Maori households be omitted. This gives an increase of only 242 on the 1926 figure of 158,856, and therefore represents a very distinct fall in the proportion of poultry-keeping households to total households. For this a number of reasons at once suggest themselves. In rural districts there were 99,766 flocks aggregating 2,917,039 birds. In cities, boroughs, and town districts there were 66,588 flocks containing 1,102,037 birds. There has been a definite decline in poultry—both in flocks and in number of birds—kept in urban districts. Apart from other influences, the filling-up of towns and the tendency towards flats and apartments would preclude to many the keeping of poultry.

Omitting geese and turkeys, and dealing with fowls and ducks only, the size of the average flock is some 23·3 birds. The great majority of flocks are small, 81 per cent. of the total containing fewer than 25 birds, and it is clear that the bulk of New Zealand's poultry is to be found not in the large flocks of the poultry-farmer, but in the small flocks which the rural or urban householder maintains as an incidental to his other pursuits. Flocks of fowls or ducks were as follows :—

Birds.	Flocks.	Birds.	Flocks.
1– 11	65,669	300–399	258
12– 24	68,479	400–499	167
25– 49	21,286	500–749	202
50– 74	5,266	750–999	108
75– 99	2,030	1,000 or over	194
100–149	1,179		
150–199	565	Total	165,949
200–299	546		

While the above figures show a fall in the proportion of poultry-keeping householders to total householders, the returns also show that there were 504 flocks of 500 birds and over, as compared with 214 flocks of 500 birds and over in 1926, which would indicate that a larger number of poultry-keepers are specializing in the business and depending upon poultry as a means of a good deal of their livelihood.

Introducing Fresh Blood.

Where it is intended to purchase eggs for incubation, day-old chicks, or young pullets during the season it is advisable to place orders early, for by so doing breeders can make arrangements accordingly, and intending purchasers are not likely to be disappointed.

There are many strains of stock of high production to select from, and it is not difficult to breed for high egg-production, but it is always a difficult matter to keep on breeding for great egg-production and retain that vigour and constitution which are so essential.

Good egg-production is of course necessary, but if breeding-stock are continually selected for egg-production alone there is a tendency for the individual birds of a flock to become too small, and offspring from such parents are more likely to be constitutionally affected and difficult to rear Body size and weight should be maintained, and it is advisable to watch this point when selecting fresh blood. If fresh cockerels are to be purchased for the coming breeding-season no time should be lost in placing orders, for if this is left till just near mating-time one is not likely to get the best selection Those requiring fresh cockerels for next breeding-season may, if they so wish, purchase three different blood lines from this Department's Wallaceville Poultry Station. White Leghorn cockerels of pure Wallaceville blood, pure New South Wales blood, and half Wallaceville and New South Wales blood are for sale at from 20s. to 40s. each, according to quality. Full particulars may be had from the Poultry Overseer, Wallaceville.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Winter Precautions.

BEFORE the cold weather sets in every hive should be examined in order to make sure that the frames are completely covered with sufficient dry, well-fitting mats to keep the bees protected. Wherever a damp or mouldy mat is discovered it should be replaced with a dry one, and the roof examined and repaired. No draughts should be allowed around the frames. Mats made of corn-sacks cut to the exact size of a zinc queen-excluder answer all requirements of warmth. They should be placed in their exact position. If placed crookedly the edges are apt to be pushed out between the hive-body and the roof, and if so, in time the mats absorb enough moisture to make them damp and unwholesome.

Once more the time approaches when the necessity for shelter should impress itself on the beekeeper. It is most essential that the bees be protected from cold winds during the winter. Should no permanent shelter be available, something temporary should be erected if the bees are expected to prove in normal condition in the spring. Manuka scrub is excellent for making a temporary wind-break.

Weeds and grass should be kept down. A good clearing round the hives in autumn suffices until spring, and adds materially to the comfort of the bees and the well-being of the hives. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

Care of Hives.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground to the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This tends to keep them free from slaters (wood-lice) and other insects, and affords less harbour for mice. Further, it ensures that the hives have a free current of air beneath the bottom-boards and are thus more likely to keep dry. If the bottom-boards rest on the ground they rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they hardly are to be advocated on that account, because the beekeeper usually finds that towards the end of the honey-flow the bees use much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them drains off the alighting-board.

Apart from disease, there is no worse feature in an apiary than the presence of leaky hive-covers. A roof which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution unspeakable on the bottom-board, where the intruding moisture mixing with dead bees and waste pollen forms a fermenting mass, with a stench which the order-loving bees must find more obnoxious than does their owner. There is no excuse for leaky covers. In the autumn the apiarist should examine the covers for any doubtful spots, and should either cover them with zinc, ruberoid, or some other water-proof material. If economy must be practised he may cover with cheesecloth, applying to the roof first a coat of paint, then the cheesecloth, and then another coat of paint. This makes an effective water-proofing, and one which anybody can apply.

Plans for Next Season.

The "off" season is the best time to make plans for the following season. The beekeeper should decide what increase he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and, while the bees are in a dormant condition, study the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor influences the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

As the present time is a critical period for produce in storage, it should be examined carefully at intervals. Well-grown produce of suitable varieties thoroughly cured and under the best storage conditions usually may be carried profitably for the maximum period. There are, however, circumstances beyond the control of the most experienced growers which may act adversely on the condition of a crop, as, for instance, the high rainfall which has been experienced in many districts during the past season. The keeping-quality has then to be carefully estimated to enable one to hold the produce as long as possible or ship it to a distant market satisfactorily. In addition to noting the behaviour of minor diseases which may be present, the temperature and humidity of the atmosphere of the store should be carefully adjusted by ventilation. During the early stages of the storage period respiration and transpiration are most active, and gases and moisture are given off in considerable quantities by produce of all kinds. These should be got rid of to a great extent by means of ventilation at suitable periods and by circulating the air in the store, thus checking the bacterial action which may cause decay. The optimum conditions are more readily maintained where the produce is stacked in an open manner to permit circulation of the air. Large stacks tightly packed are most difficult to hold satisfactorily.

The new crop of vegetable-seeds is now available, and consideration should be given to the requirements of the coming season. There is often little to distinguish good seed from bad seed. This naturally makes buying difficult, as there is no means of ascertaining the strain before purchasing. Vitality may be known by germinating a counted quantity; and the impurity of a sample may be to some extent defined by examination.

In no other transaction probably is the buyer at such a disadvantage and so dependent upon the integrity of the seller as in buying seeds. Under such circumstances one buys seed for commercial cropping only from those who have the necessary experience and reliability; neither does one quibble about the price. As a rule cheap seeds have to be stocked for those who cannot resist driving a bargain, but such are generally useless to a commercial grower. To plant out an acre or so of cabbage that does not "heart" or of cauliflower that does not "head" up is something more than a disappointment. Seeds, therefore, of the best strain should be obtained, because they contain qualities for which no cultural skill or attention can be substituted.

On the farm these seeds are often kept in tins or bottles to protect them from the attack of vermin, and in the more humid localities this is perhaps quite the best place for them so long as the conditions are dry. Seeds retain their vitality longest when they are mature, well cured, and stored in a dry place. Humid conditions are most detrimental, especially when the temperature is high. Where storage conditions are good, seeds may be tested for strain the first season, and, if approved, may be sown for a field crop the following season, thus avoiding the risk of serious loss.

Similar precautions are quite as necessary when purchasing potato "seed." Mixed varieties and many diseases may be present and not discernible until growth commences. So serious has been the loss from crops grown from potato-seed containing rogues and tubers infected with virus disease that a system of Government certification has been instituted. To obtain a certificate the seed is grown under close inspection by an authorized person, and a certificate is granted only if the crop proves to be up to the strict specification laid down as regarding purity, disease, and cropping-capacity. Undoubtedly commercial cropping—or any other—should be done only with potato-seed of this class, and this especially in the warmer localities, where virus diseases are always most prevalent. Potato-seed should be obtained as soon as it is available to make sure it receives suitable storage conditions. The early varieties especially are best sprouted in trays for a month or so before sowing, the trays being stacked in a light but not sunny position.

Next to good seed, successful cropping of this kind depends on the suitable preparation of the land. This requires a great deal of consideration where the cropping is intensive if it is to be both economical and efficient.

The chemical, biological, and mechanical condition of the soil have all to receive constant attention The first has special reference to the supply of plant-foods ; the second to the position as regards insect pests, fungous diseases, and weeds present in the soil ; the third as regards to the friability of the soil and drainage. For planting out comparatively permanent herbaceous crops such as rhubarb and asparagus the land should be clean, rich in humus, and deeply worked, as only superficial cultivation and manuring can be done after establishment In any case, heavy land is retentive, slow in coming into condition, and therefore requires early preparation. It clods badly if worked when wet or when nitrate of soda is used consistently Sulphate of ammonia is a more suitable form of soluble nitrogen, and applications of lime must be made from time to time On the other hand, a light soil is " hungry " and easily brought into condition. It is best prepared late, using organic manures freely Owing to rapid assimilation and leaching, artificial fertilizers should be used in comparatively small quantities at frequent intervals. Nitrate of soda is a suitable stimulant for forcing growth, but its extensive use on such land should be balanced by the inclusion of sulphate of potash.

The preparation of land of any class should be carried out sufficiently early to allow it to settle for a fortnight or so before planting and especially before sowing fine seeds Weed-seeds near the surface will then sprout, and may be destroyed by shallow hoeing during a fine day, after which the crop may be sown under best conditions

Manure and compost heaps should be turned two or three times at intervals in order to obtain uniform decomposition and to mix the ingredients thoroughly before use.

Wet days provide opportunities for cleaning, repairing, and adjusting apparatus and implements. It is specially necessary where labour is employed to see that all tools, implements, and machines are put away, in clean condition after use, in their allotted position . they then give efficient service over a maximum period, and time and opportunities are not wasted when there is work to be done. Spray-pumps, tractors, seed and manure drills, &c., are now used extensively, and necessary repairs should be done now in preparation for the busy spring season.

Small and Sundry Fruits.

Established plantations of bush fruits will now require pruning, manuring, and cultivation. These plants generally will remain in profitable condition for eight or ten years, sometimes longer, depending on the quality of the land and the treatment given them, also on the diseases present. Where the plantations are old and infested with disease and pests, they should be pulled, piled, and burnt, and a new plantation set out on fresh ground.

Black currants, gooseberries, raspberries, and other kinds which carry the crop on young wood should now have the old wood cut out unless it has already been done ; also superfluous young wood removed where it is weak or crowded. This leaves a good selection of young wood for cropping next season, and encourages the growth of a crop of young wood to follow on. This also opens up the bushes to the air and light, which are so necessary for the production of good blossom and fruit. A common mistake is that they are not opened out sufficiently. The raspberries only require to have the young wood shortened back ; this should be done so as to remove the unripened growth and leave only firm, well-ripened wood.

Red currants and others which carry the fruit on spurs on old wood should have all suckers removed completely, and lateral and leading growth shortened back. As leaders become exhausted with cropping they should be removed and new growth trained in, as opportunity offers, to replace them.

Great care is necessary when cultivating these crops, as their fibrous roots are produced near the surface of the ground. At this season a green crop or a dressing of well-cured farm manure may be ploughed in with advantage, so long as the plough is set not deeper than 6 in. On shallow soils, or where cultivation to that depth has not previously been done, the depth of the cultivation should not exceed what has been customary. The addition of a good dressing of bone-dust and sulphate of potash will generally be beneficial, especially on the lighter lands. Most of these crops require more potash than they receive, and it is generally best given in the form of sulphate of potash. A dressing of nitrogenous fertilizer may be given in spring as required, but it should be remembered that an over-vigorous growth is not always the most fruitful.

Preparations for the glasshouse tomato crops will now be under way. The most important requirements for successful cropping are sturdy plants of a good strain, a thoroughly clean house in good repair, and a well-prepared soil. Good plants are obtained by growing them steadily and avoiding the temptation to force the growth by means of high temperatures and a humid atmosphere. There should be no doubt about the house being thoroughly free from the infection of plant-diseases. Serious attacks are generally due to neglect, in some respects, regarding the proper disinfection of the house when clearing out last season's crop. Where the same crop is grown for many years in succession in the same ground, the diseases peculiar to it have a natural tendency to become firmly established unless special precautions are taken. Preparation of the land for planting out should be commenced in ample time to carry it out properly. A common mistake is to plant out in land that is too dry. As it is not subject to natural winter rains it should be irrigated some weeks before planting, so that both soil and subsoil are thoroughly moist. It will have time to warm up and the surface to dry off sufficiently for planting to be done under the best conditions. Comparatively little further watering will then be required by the crop during the critical period in spring when dealing with low temperatures.

The Homestead Garden.

Fallen leaves and waste organic materials should be stacked in a humid locality to decay, and so be converted into humus for manurial purposes.

Repairs to roads and walks should be attended to now. Before applying fresh metal, attention should be given to correcting faults in grading the surface so that storm-water will drain off instead of lodging. Gateways and other places where the traffic is concentrated require special attention. Not only is appearance and comfort greatly enhanced when this is regularly and properly done, but the work about the place is facilitated.

—*W. C. Hyde, Horticulturist, Wellington.*

DEPARTMENT OF AGRICULTURE.

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WEATHER RECORDS: APRIL, 1937.

Dominion Meteorological Office.

NOTES FOR APRIL.

THE first half of April was warm, and, except in the northern portion of the North Island, dry. Since there was, in most parts, comparatively little wind, conditions were very pleasant. Vegetation flourished and stock were doing well. The second half, however, was very cold for the time of year, and, although not in general heavy, rain was frequent. The ground became cold and saturated, and growth, to a large extent, ceased. There is more snow on the ranges than usual at this time of year.

Rainfall was above average in North Auckland, at Tauranga, near East Cape, in the South Taranaki Bight from Wanganui to Hawera and thence inland, and over most of Otago and Southland. In parts of the last-mentioned area the total was double the normal value. Elsewhere there was generally a considerable defect from the average. Rain was very frequent throughout the month in North Auckland and in the East Cape area, while from the 20th onward it was frequent almost everywhere.

Temperatures.—The mean temperature for the month was almost everywhere below normal. The only exceptions occurred at a few places in the Auckland Province, where the departures were, in general, rather small. Over the North Island as a whole the average departure was about 1° F. Over the South Island conditions were definitely colder, and the mean departure was about 2° F. Several frosts occurred and tender plants were cut off at a rather early date in most districts.

Sunshine.—There was more bright sunshine than usual over most of the southern half of the North Island and at Blenheim and Timaru, but in most other parts considerably less.

Pressure and Storm Systems. The month began with a series of rather deep westerly depressions crossing the South Island. On the 3rd an anticyclone began to approach from the Tasman Sea. Southerly winds set in and were strong in many places. Some snow fell on the mountains at this time. The anticyclone became intense as it reached New Zealand, and its centre moved to the east coast of the South Island on the night of the 4th. Strong south-easterly winds continued to blow to the northwards, and the vigorous invasion of cold air into low latitudes led to the development of a cyclone in the Norfolk Island region. From the 7th the anticyclone began to move away eastwards. Thereafter, a series of depressions developed over the Tasman Sea and the Dominion, the pressure generally showing a falling tendency until the 17th, when there was a brief rise and southerly winds prevailed. During this period and until the 19th there was no very stormy weather.

On the 20th another spell of westerly weather commenced. Strong westerly winds prevailed, and on the 23rd gale force was reached in many places from Nelson and Marlborough northward. By the 24th the last of the deep westerly depressions had passed. Barometers rose and strong south-westerly winds to gales prevailed until the 26th, when they began to decrease. There was much snow on the ranges from the 22nd to the 25th, and numerous hail and thunder storms occurred. Some flooding was experienced in Otago. On the 23rd a number of small tornadoes were reported from the western side of the North Island, each doing considerable damage over a short and narrow path.

RAINFALLS FOR APRIL, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Fall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	6·99	20	2·38	4·42	21·70	14·96
Russell	5·05	14	1·77	4·44	29·20	16·86
Whangarei	5·86	23	0·95	4·93	24·20	17·18
Auckland	2·71	19	0·52	3·88	11·70	13·69
Hamilton	3·64	15	0·95	3·85	13·64	14·09
Rotorua	3·16	17	0·76	4·41	16·81	15·91
Kawhia	3·32	8	0·94	4·65	12·69	14·48
New Plymouth	4·14	14	1·05	4·59	21·44	16·39
Riversdale, Inglewood	5·32	14	1·44	8·11	35·45	28·69
Whangamomona	4·09	7	2·04	6·52	24·29	20·97
Hawera	4·32	14	1·12	3·48	16·20	12·40
Tairua	3·76	20	0·75	5·96	16·81	19·51
Tauranga	7·54	19	1·85	4·70	20·06	16·43
Maraehako Station, Opotiki	3·56	13	1·33	4·74	21·22	16·43
Gisborne	3·32	13	0·67	4·05	12·17	14·65
Taupo	2·89	16	0·73	3·60	11·37	12·85
Napier	1·03	9	0·30	2·36	7·65	9·98
Hastings	0·68	8	0·28	3·33	4·55	10·27
Whakarara Station	2·39	9	0·35	..	11·06	..
Taihape	3·21	10	1·05	2·78	11·15	10·97
Masterton	1·29	10	0·40	3·05	10·03	11·14
Patea	4·03	12	0·78	3·67	16·76	13·01
Wanganui	3·34	9	1·14	3·27	13·47	10·99
Foxton	1·81	11	1·17	2·50	8·98	8·69
Wellington	2·30	14	0·68	3·64	11·92	12·48
			South Island.			
Westport	6·34	13	1·38	8·25	32·31	29·30
Greymouth	5·57	18	0·83	8·48	41·05	32·66
Hokitika	8·94	18	1·40	9·46	44·88	36·29
Ross	9·95	16	1·70	12·18	52·95	44·21
Arthur's Pass	12·45	10	4·83	15·42	58·20	52·63
Okuru, South Westland	18·66	14	4·10	14·12	59·40	50·52
Collingwood	6·53	14	1·57	8·15	31·54	25·81
Nelson	2·21	15	0·48	3·10	11·92	11·55
Spring Creek, Blenheim	1·04	8	0·25	2·12	8·89	8·50
Seddon	1·08	9	0·29	1·71	7·44	7·40
Hanmer Springs	1·62	11	0·54	3·37	9·58	13·84
Highfield, Waiau	2·02	7	0·86	2·60	6·33	11·02
Gore Bay	1·96	11	0·55	2·38	8·30	9·77
Christchurch	1·49	11	0·44	1·75	7·74	7·48
Timaru	1·65	11	1·20	1·57	9·54	7·91
Lambrook Station, Fairlie	1·30	7	0·37	1·97	8·84	8·55
Benmore Station, Clearburn	2·86	12	0·82	2·40	12·94	9·20
Oamaru	1·63	15	0·37	1·79	7·09	7·40
Queenstown	3·02	14	0·85	3·08	12·85	10·54
Clyde	1·59	7	0·58	1·45	7·90	5·85
Dunedin	5·61	19	1·32	2·77	18·99	11·79
Wendon	5·01	15	0·81	2·71	22·37	10·91
Balclutha	4·25	17	0·76	2·19	16·52	8·80
Invercargill	3·07	20	0·56	4·24	18·24	15·31
Puysegur Point	7·39	25	1·60	7·67	36·83	29·00
Half-moon Bay	4·62	21	0·75	5·10	24·68	19·37

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TOMATO-SEEDLING DAMPING-OFF.

CONTROL BY SEED DUSTING.

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IN a previous paper (Brien and Chamberlain, 1936) on the control of tomato-seedling damping-off, it was pointed out that the organisms responsible were soil fungi, and that control of the disease could be secured only by soil treatments.

If a suitable therapeutant is applied to the surface of the seed before sowing, the soil in its immediate vicinity is disinfected, and protection is given to the young seedlings during the period they are susceptible to attack. Therapeutants are most conveniently applied to the seed in the form of dusts. Experiments described herein were undertaken to test the efficiency of this method and to determine which dusts gave the best control.

REVIEW OF LITERATURE.

Experiments carried out by Godbout (1930) with " Bayer dip dust," " Semesan," and nickel sulphide as seed dusts, showed that " Bayer dip dust " and " Semesan " gave satisfactory control of damping-off (*Pythium de Baryanum*), on muskmelon, cucumber, radish, cabbage, and brussels sprouts. Horsfall (1932A) in a series of experiments on the control of tomato-seedling damping-off (*Pythium ultimum*) used red copper oxide, copper carbonate, and copper sulphate. He found that red copper oxide was more effective than copper carbonate for both pre- and post-emergent phases of the disease, but was less satisfactory than copper-sulphate dust for the pre-emergent phase. The same writer (Horsfall, 1932B) showed that monohydrated copper sulphate was more effective than copper carbonate in protecting tomato-seedlings against both phases of damping-off. Anhydrous copper sulphate was shown to be equally efficient, but Horsfall did not recommend it for general practice because of its high cost.

EXPERIMENTAL METHOD.

The experiments were carried out in the glasshouse using a soil-mixture of clay loam and silt in seed-boxes 18 in. by 12 in. by 3 in. Seven to ten days prior to sowing, the soil, either untreated or steam-disinfected, was inoculated with cultures of *Pythium ultimum* grown on potato dextrose agar.

Seed was shaken with the dust for five minutes in a glass vessel, the excess being then screened off. The seed was sown at the rate of either $\frac{1}{14}$ oz. or 500 seeds per box. Following the appearance of damping-off, counts of infected plants were taken daily. Final counts of the healthy plants left in the boxes were taken four to five weeks after sowing, by which time they had advanced beyond the damping-off stage.

The following dust materials were tested :—

(1) "*Ceresan U.T. 1875.*"—This proprietary organic mercury dust contains, as its active constituent, mercury-phenyl-acetate.

(2) "*Agrosan G.*"—Another proprietary organic mercury dust, of which the active constituent is mercury-tolyl-acetate.

(3) *Monohydrated Copper Sulphate.*—A dust prepared by heating crystalline copper sulphate at 105° C. The crystals break down to a fine pale blue powder. It is unstable when exposed to air, and must therefore be stored in an airtight glass or earthenware container.

(4) *Copper Carbonate.*—For the purpose was used a high-grade basic copper carbonate having a copper content of 50 per cent. to 54 per cent., and a particle size less than 10 microns.

(5) *Red Copper Oxide (Cuprous Oxide).*—This is not a standardized material, the commercial article being of variable purity. It is unstable in the presence of air.

(6) *Copper Oxychloride.*—A proprietary product marketed under the name of "Smutol" was used. It has a copper content of 54 per cent., and particles averaging 5 microns in diameter.

(7) "*R.D. 7312.*"—An organic mercury dust the active constituent of which is ethyl-mercury-phosphate. This dust is still in the experimental stage, and has not been placed on the market.

"Ceresan," "Agrosan G.," copper carbonate, and copper oxychloride are all available in New Zealand.

EXPERIMENT I.

"Ceresan," monohydrated copper sulphate, red copper oxide, copper carbonate, and copper oxychloride were used. The soil was inoculated on 13th August, 1935, and on the 5th September was sown with

Sutton's Best of All tomato-seed at the rate of $\frac{1}{14}$ oz. per box. The seed gave a germination test of 99 per cent. in ten days. Results are given in Table I :—

Table I.—Results of Experiment I : Seed sown in Untreated Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off		Average Percentage of Plants damped-off.	Remarks on Germination
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 258	44	28	76	..
	Box B = 198	58	22		
Monohydrated copper sulphate	Box A = 440	6	9	20	..
	Box B = 402	14	11		
" Ceresan " ..	Box A = 454	3	13	21	Slight delay.
	Box B = 449	4	9		
Copper carbonate ..	Box A = 463	1	12	23	Slight delay.
	Box B = 408	12	20		
Copper oxychloride	Box A = 407	13	15	24	..
	Box B = 441	5	15		
Red copper oxide ..	Box A = 405	13	9	18	..
	Box B = 428	8	5		
*Steam-disinfected soil	Box A = 469	0	0	0	Slight delay.
	Box B = 463	0	0		

* Untreated seed was sown in steam-disinfected soil, the average germination per box being taken as representing complete germination and used as a basis on which to calculate the percentage of damping-off occurring in the seed-dust treatments. The same method of calculation was used in Experiments II, III, and IV.

EXPERIMENTS II, III, AND IV.

In these were used the seed dusts " Ceresan," " Agrosan G.," copper carbonate, and " R.D. 7312." The soil was inoculated on the 6th July, 1936, and sown on the 29th July with Sutton's Best of All tomato-seed, which gave a laboratory germination test of 99 per cent. in ten days. The seed was sown at the rate of 500 per box.

In experiment II seed was sown in steam-disinfected soil which had been subsequently inoculated with the damping-off fungus. Soil used in experiment III was untreated and inoculated with *P. ultimum.* Soil for experiment IV was untreated and uninoculated. Results are given in Tables II, III, and IV :—

Table II.—Results of Experiment II : Seed sown in Steam-disinfected Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 83	83	11	94	..
	Box B = 64	87	7		
" Ceresan " ..	Box A = 318	36	14	51	..
	Box B = 326	34	17		
Copper carbonate ..	Box A = 413	17	25	39	Slight delay.
	Box B = 442	11	24		
" R.D. 7312 " ..	Box A = 385	22	8	31	Much delay.
	Box B = 367	26	6		
Steam - disinfected soil not inoculated	Box A = 500	0	0	0	..
	Box B = 492	0	0		

Table III.—Results of Experiment III: Seed sown in Untreated Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 185	63	15	67	..
	Box B = 300	40	16		
"Ceresan" ..	Box A = 481	3	3	5	..
	Box B = 485	2	2		
"Agrosan G." ..	Box A = 394	21	3	18	..
	Box B = 451	9	3		
Copper carbonate ..	Box A = 480	3	10	16	..
	Box B = 453	9	9		
"R.D. 7312" ..	Box A = 450	9	3	11	Delayed.
	Box B = 458	8	2		
Steam - disinfected soil not inoculated	Box A = 500	0	0	0	..
	Box B = 492	0	0		

Table IV.—Results of Experiment IV: Seed sown in Farm Soil naturally infected with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 337	32	18	39	..
	Box B = 423	15	13		
"Ceresan" ..	Box A = 487	2	7	10	..
	Box B = 466	6	4		
Copper carbonate ..	Box A = 464	6	4	13	..
	Box B = 472	5	10		
"R.D. 7312" ..	Box A = 462	7	1	7	Delayed.
	Box B = 477	4	2		
Steam - disinfected soil not inoculated	Box A = 500	0	0	0	..
	Box B = 492	0	0		

EXPERIMENT V.

"Ceresan," "Agrosan G.," copper carbonate, and "R.D. 7312" were again used. Untreated soil was inoculated on the 8th September, 1936, with *P. ultimum*, and the tomato-seed sown on the 29th September, at the rate of 500 per box. The seed was of the same variety as used in the other experiments. Results are given in Table V:—

Table V.—Results of Experiment V: Seed sown in Untreated Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		*Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 236	53	14	69	..
	Box B = 205	59	12		
"Ceresan" ..	Box A = 483	4	1	5	..
	Box B = 476	4	1		
"Agrosan G." ..	Box A = 463	7	2	14	..
	Box B = 434	13	5		
Copper carbonate ..	Box A = 455	9	3	11	..
	Box B = 462	8	2		
"R.D. 7312" ..	Box A = 430	14	2	14	Much delayed.
	Box B = 450	10	1		

* The percentage damping-off was calculated on the assumption that the seed was capable of giving 100 per cent. germination.

DISCUSSION OF RESULTS.

All dusts tested gave seedlings a decided protection against damping-off caused by *P. ultimum*, but none gave complete control. Damping-off was more difficult to control in soil which had been steam-disinfected before being inoculated with the damping-off fungus. Results reported in our previous paper showed that this applied also with soil treatments. The results of experiment IV showed that the farm soil used for these experiments was naturally infected with *P. ultimum* and illustrates the wide distribution of the fungus.

(1) "*Ceresan U.T. 1875.*"—Although it failed to give good control in steam-disinfected soil inoculated with *P. ultimum*, this dust gave consistently good results in the other four experiments (see Figs. 1 and 2). It caused slight delay in germination in one experiment.

(2) "*Agrosan G.*"—This dust gave fairly good results in the two tests made. It was less efficacious than "Ceresan" or copper carbonate. No delay in germination resulted from its use.

(3) *Monohydrated Copper Sulphate.*—Promising results were secured in the one test made. It controlled damping-off slightly better than did either "Ceresan" or copper carbonate, and caused no delay in germination.

(4) *Copper Carbonate.*—Consistent results were secured in all tests (Fig. 2). In one experiment it gave better control than "Ceresan," but in the other four it proved slightly less efficacious. Slight delay in germination occurred in two of the experiments.

(5) *Red Copper Oxide.*—In the one test it gave promising results, being slightly more efficacious than "Ceresan," copper carbonate, or monohydrated copper sulphate (see Fig. 1).

(6) *Copper Oxychloride* in the one test proved slightly less efficient than "Ceresan," copper carbonate, monohydrated copper sulphate, or red copper oxide.

(7) "*R.D. 7312.*"—In the three experiments this dust gave consistently good control of damping-off, but caused severe injury to the seedlings (see Fig. 3).

RECOMMENDATIONS.

None of the dust materials gave complete control of damping-off. Sufficiently good results were obtained, however, to warrant their use by growers who have not the facilities for treating their soil. Organic mercury dusts such as " Ceresan " or " Agrosan G.," or high-grade copper

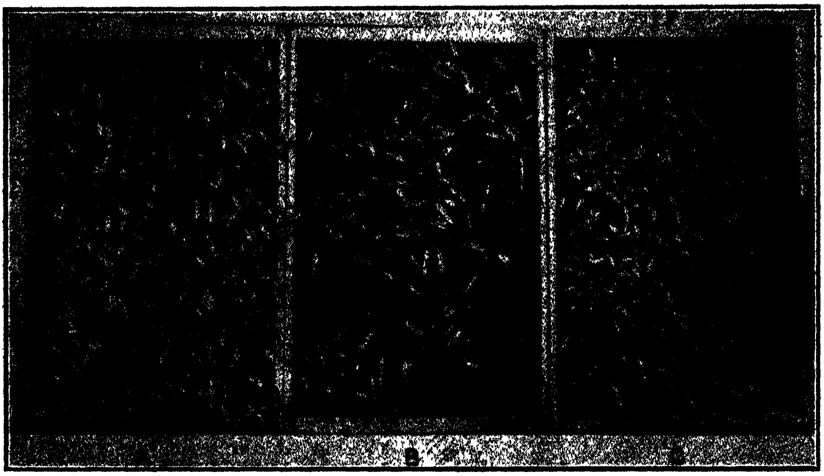

FIG I. EFFECT OF SEED DUSTS ON TOMATO-SEEDLING DAMPING-OFF.

All three boxes contained untreated soil to which cultures of *Pythium ultimum* had been added : A, seed dusted with " Ceresan " ; B, untreated seed ; C, seed dusted with red copper oxide.

[*Photo by H. Drake.*

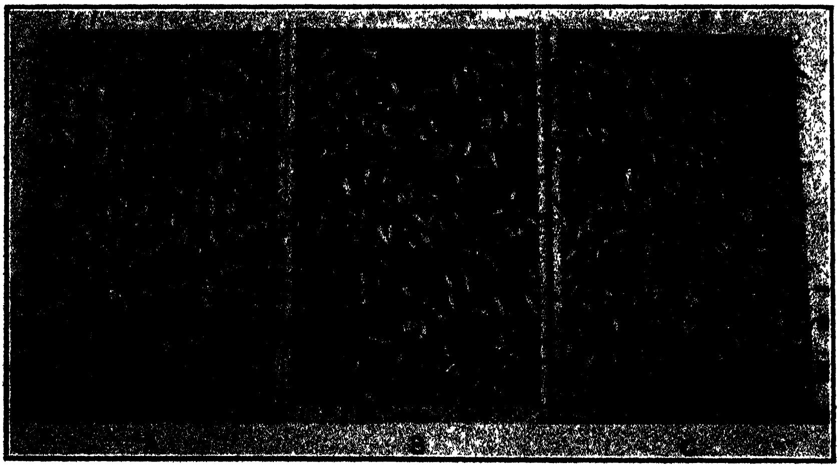

FIG. 2. EFFECT OF SEED DUSTS ON TOMATO-SEEDLING DAMPING-OFF.

Box A contained untreated soil inoculated with *Pythium ultimum*, while boxes B and C contained farm soil naturally infected with this fungus : A, seed dusted with " Ceresan " ; B, untreated seed ; C, seed dusted with copper carbonate.

[*Photo by H. Drake.*

carbonate are recommended under such conditions. They do not take the place of soil treatments, so that, where practicable, growers are recommended to disinfect seed-box soils by the practices outlined in our previous paper.

SUMMARY.

(1) Results are given of experiments with various seed dusts for the control of tomato-seedling damping-off (*Pythium ultimum*).

(2) Damping-off was more severe and more difficult to control in soil which had been steam-disinfected prior to the addition of cultures of *P. ultimum*.

FIG. 3. SEEDLING INJURY CAUSED BY SEED DUST

Two seedlings on left grown from seed dusted with copper carbonate Seedlings on right showing injury resulting from use of an experimental dust " R.D 7312 "

[*Photo by H Drake.*

(3) None of the dusts tested completely eliminated the disease. Several, however, gave a high percentage of control.

(4) It is suggested that growers who have not the facilities for soil disinfection, may combat damping-off by using such seed dusts as " Ceresan," " Agrosan G.," or copper carbonate.

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GRASSING OF CONSOLIDATED SAND AREAS, NORTHERN WAIROA, NORTH AUCKLAND.

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FARMERS are always interested in virgin land that can be quickly and cheaply converted into good pasture-land, and the consolidated sand areas of the Northern Wairoa offer considerable scope for development in this direction. The extensive grassing-work carried out in the development of this land for settlement under the Small Farms Act has shown that good permanent pastures can be quickly established on this land, provided the soil is carefully cultivated, permanent species of grasses and clovers are sown, and the pastures adequately manured with superphosphate.

Mr. N. H. Taylor, of the Soil Survey Division of the Department of Scientific and Industrial Research, who, at my request, made a brief examination of the area, supplied the soil map and wrote the following sections dealing with topography and soils.

LOCATION AND CLIMATE.

The district referred to in this article as the sand country of the Northern Wairoa is a strip of land fifty miles long and approximately five miles wide, extending from Mangonui Bluff to Kaipara North Head, and lying between the Kaihu and Wairoa Rivers on the east and the sea on the west.

The mean annual rainfall for the district is 50 in., with 150 rainy days per annum(1). The mean monthly temperatures vary from about 63° F. in January and February to 50° F. in August(2). The area is swept by the prevailing westerly winds.

TOPOGRAPHY.

The greater part of the district (a strip along the western side two to three miles wide) is an area of flat-topped spurs and steep-sided valleys, the floors of which are occupied by peaty swamps. In the north the flat-topped spurs reach heights of 400 ft., and 500 ft., but farther south few rise more than 300 ft. above sea-level. West of Mamaranui, where the streams are closely spaced, the bleak, scrub-covered spur-tops and steep valley-sides, scarred with white slips, present a most dismal appearance, but west of Dargaville, where the land is lower, broad flattish spur-tops are the most conspicuous features of the landscape.

The whole of this area is underlain by consolidated water-sorted sands, interbedded with which are small lenses of lignite. On the west the water-sorted sands are buried by drifts of wind-blown sand, but they appear again in an almost unbroken line of cliffs bordering the shore.

The blown-sand country of the west is of three types: (1) The older fixed dunes; (2) the younger fixed dunes; and (3) the bare sand-drifts.

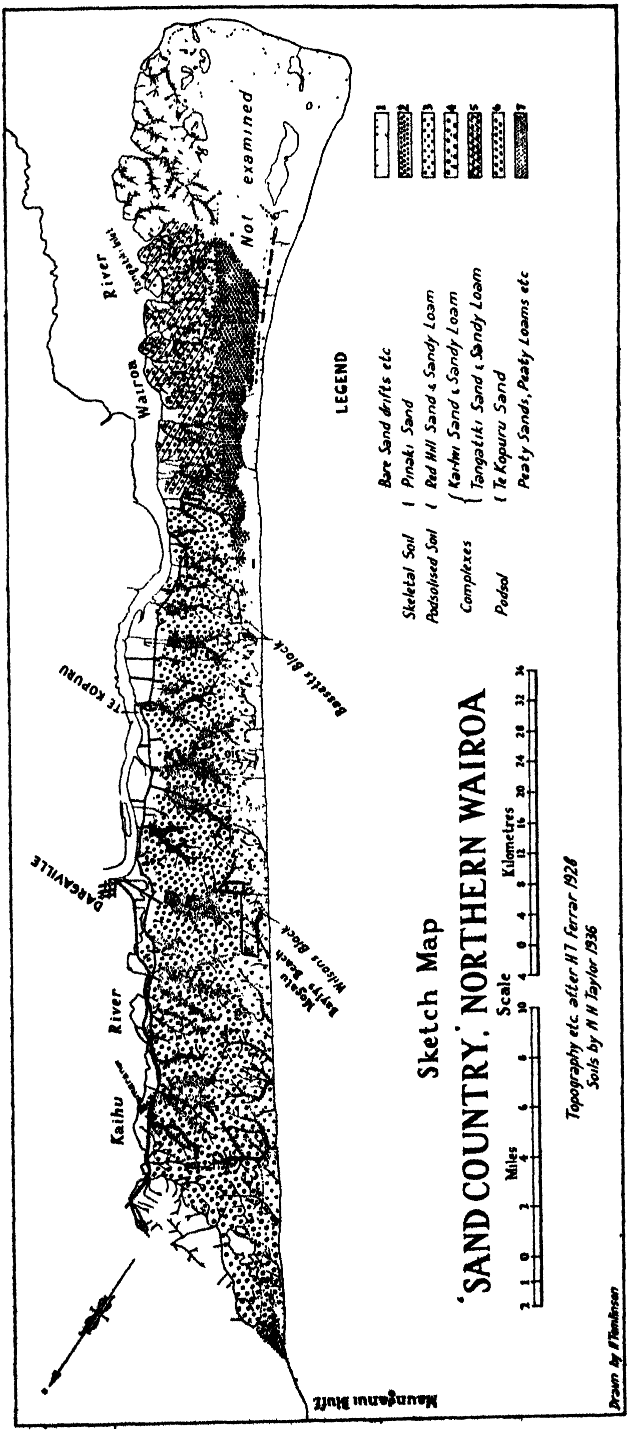

FIG. 1. SOIL MAP OF SAND COUNTRY, NORTHERN WAIROA.

The older fixed dunes form a belt of rolling country about a mile wide extending from Kai Iwi Stream to the Tikinui coast road, a distance of about twenty-eight miles. The hills are smoothly rounded and the sand is permanently fixed by weathering.

The younger fixed dunes cover a wedge-shaped strip thirty miles long, lying south of the older fixed dunes. The country, though described as rolling, is more broken than the area covered by the older fixed dunes, for the hills still have the typical dune shape with irregular crest lines and steep lee slopes. The sand is fixed by vegetation, but weathering has not yet fixed the dunes permanently.

The bare sand-drifts (Fig. 2) cover about thirty square miles of the country close to Kaipara North Head, and northwards they taper to a strip flanking the shore, rarely more than half a mile wide. Sand thrown upon the shore by waves is carried inland by the wind, where it accumulates as dunes, which move steadily forward. While they are growing the dunes have a regular shape (steep lee slopes and gentler slopes to windward), but farther inland, where the supply of wind is less regular, the dunes become fixed in places by sand-binding plants and are scoured by the wind into forms resembling miniature mountain ranges. Both the bare drifts and the younger fixed dunes lie athwart the drainage of the older country and dam back the streams to form lakes and ponds (Fig. 3).

SOILS.

As the soils throughout the area are somewhat similar in composition and the climate fairly uniform, the main factors leading to soil differentiation are—(1) The covering of vegetation; (2) the topography; (3) the time that has elapsed since the various sand deposits were laid down.

Under a humid climate the rock material decomposes and the soils which form tend to become leached. The vegetation gathers mineral substances from the soil and these are returned to the surface as the leaves die and fall. The vegetation, in this way, tends to work against the rainfall. Topography is important, for on steep slopes the soil tends to be eroded as fast as it is formed. The area is one which has been subjected to many scrub fires, and on this account much of the soil has been eroded. Washing by rain and slipping have removed much of the soil from the steep slopes, and in many exposed localities the unprotected soil has been so completely removed by the wind that the bare sandstone appears at the surface. Fires and over-grazing with stock, by destroying the sand-fixing vegetation, are also assisting the advance of the drifting sand.

The sand soils of the area have been mapped and are shown (Fig. 1) as belonging to five groups: (1) The Pinaki sand, which is classified as a skeletal soil—that is, a very young soil showing little alteration by soil-forming processes; (2) the Red Hill soils, classifed as podsolized soils, or soils which show a well-defined topsoil and subsoil, but have not yet reached the stage of development attained by group 3; (3) the Te Kopuru sand, classified as a podsol* on

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*A podsol is a soil in which iron and alumina from the topsoil have been leached to lower horizons, leaving a bleached layer above.

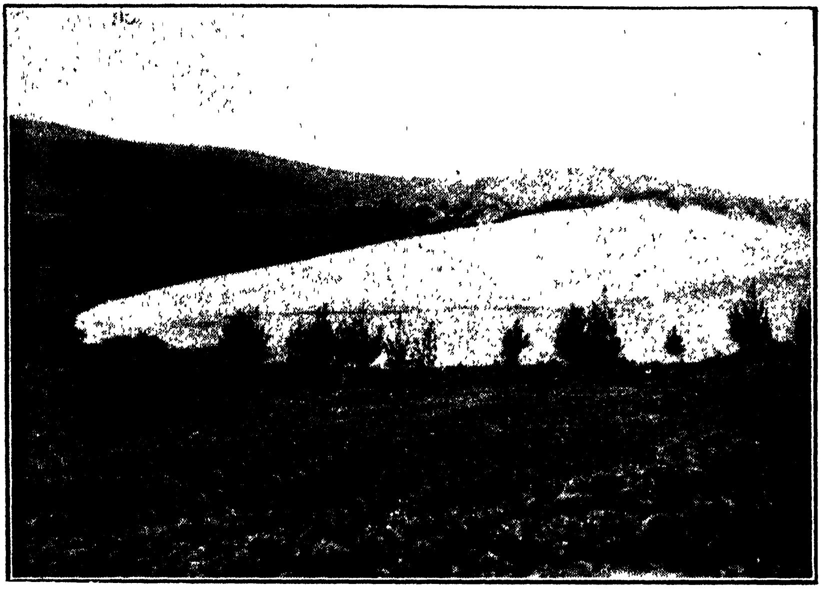

FIG. 2. BARE SAND-DRIFT INVADING THE ROLLING COUNTRY OF THE OLDER FIXED DUNES

The foreground, the typical vegetation supported by the sand

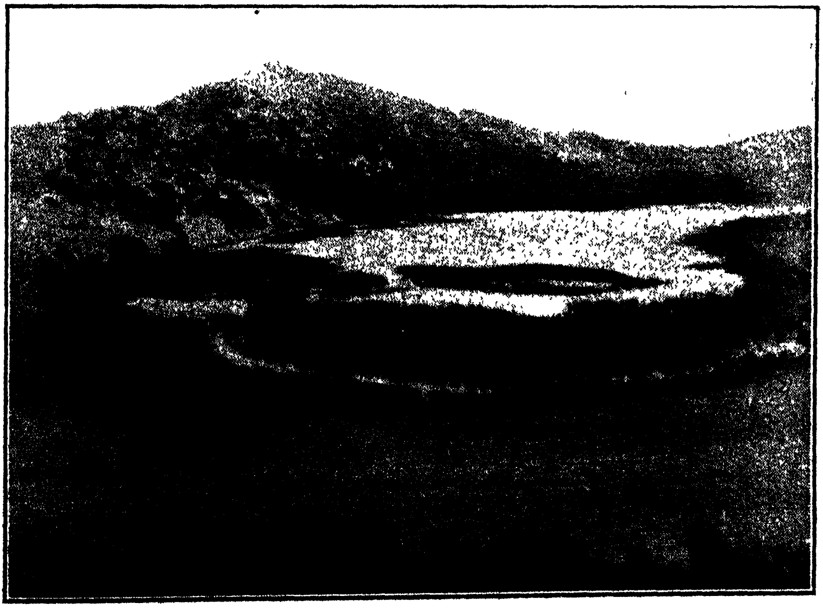

FIG. 3. POND FORMED BY THE YOUNG SAND-DUNES DAMMING BACK THE DRAINAGE OF THE OLDER FIXED DUNES.

maturely developed soil; (4) the Tangatiki; and (5) the Kai Iwi soils, classified as complexes or areas covered by a patchwork of soils resembling those of groups 2 and 3.

The Pinaki sand is a young soil, derived from the sand of the younger fixed dunes. It consists of 3 in. to 6 in. of black sand resting on a brown free sandy subsoil. The soil is overdrained, and pastures on it are subject to drought in dry spells.

The Red Hill soils are those covering the older fixed dunes. The Red Hill sandy loam is a light-brown, moderately compact soil resting on lightly cemented sands. Over the western part of the area there is a shallow covering of more recent sand, and soils affected by this covering have been grouped together as the Red Hill sand. A typical profile shows 4 in. to 10 in. of dark-grey sand resting on the moderately compact brown sandy loam. In places the subsoil is darker brown, more clayey in texture, and presents the appearance of a weathered volcanic ash. This is probably due to the fact that at certain periods much of the drift sand has consisted of pumice particles which have been brought from the mouth of the Waikato River by ocean currents and cast ashore by the waves.

The Te Kopuru sand is a soil derived from the older water-sorted sands. The soil is a mature podsol developed under a former kauri forest. A typical profile (Fig. 4) shows 5 in. of grey sand, 5 in. of whitish sand, and 6 in. of a blackish humus pan on cemented sandstone, with iron and alumina pans at different depths. The acid humus collected under the kauri forest, leached throughout the soil, carrying with it the iron and alumina and forming pans below. This soil is badly drained in winter, and, on account of the sandy texture of the topsoil, is dry during the summer. This mature profile is best developed on the flattish spur-tops and easier slopes. Where the slopes are steeper, slumping takes place, and the soils are not so mature.

The Tangatiki soils are complex soils developed on the southern part of the older water-sorted sands. On this area the kauri forest did not form such a continuous cover, and the soil pattern is a patchwork of mature soils resembling the Te Kopuru sand and brown moderately compact sandy loams, somewhat resembling the Red Hill sandy loam. On account of the steepness of much of the country, and because of the continual scrub fires, much of the soil has been eroded and in these places the sandstone is at, or near, the surface.

The Kai Iwi soils are complex soils developed on the older fixed dunes, north of the Kai Iwi Stream. This area has in the past been partly covered with kauri forest. The soil pattern is a patchwork of Te Kopuru sand and Red Hill sandy loam.

SURFACE COVERING.

The natural surface covering of the hill areas (Fig. 5), considerably modified from its primitive state, consists of light manuka scrub and bracken fern, with a sparse growth of danthonia and bay grass (*Eragrostis Brownii*). On the podsolized soils where drainage is bad, rushes and sedges cover considerable areas, while on the swamp areas flax is found growing in addition to strong rushes.

The following indigenous plants are found through the scrub and fern: *Lycopodium densum, Cladium teretifolium, Lepidosperma laterale, Halorrhagis procumbens, Microtis unifolia, Pimelea prostrata, Leucopogon Fraseri, Pomaderris phylicaefolia,* and *P. Edgerleyi.* Of introduced plants *Hakea pubescens* and *Erica stricta* occupy much ground, while pines are numerous, and *Ornithopus ebracteatus* and *Gnaphalium purpureum* are frequently met with.

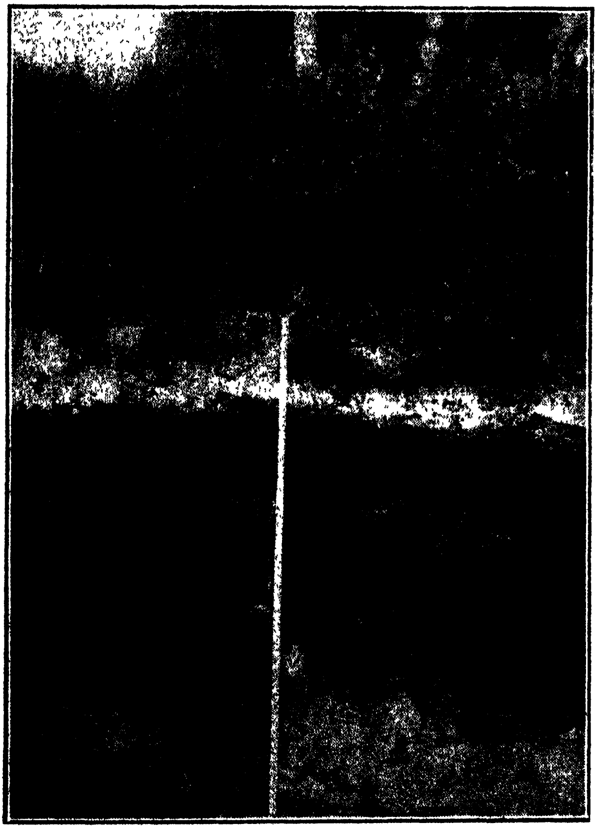

FIG. 4. PROFILE OF THE TE KOPURU SAND, WITH TYPICAL VEGETATION ABOVE.

Note the bleached layer resting on the dark humus pan 10in. to 15in. below the surface The dark lines below the humus pan are iron pans. The unaltered sandstone appears in the bottom of the picture.

Trouble is being experienced with moving sand encroaching on certain areas (Fig. 2), especially those exposed and adjacent to the sea-coast. Sand is being continually blown and swept from the beaches over the steep coastal cliffs on to the useful consolidated areas by strong westerly winds. Very successful work has been done to check and overcome this continual sand movement. Marram-grass (Fig. 6) has been found an extremely valuable plant for arresting sand movement and large areas are being planted each year with great success.

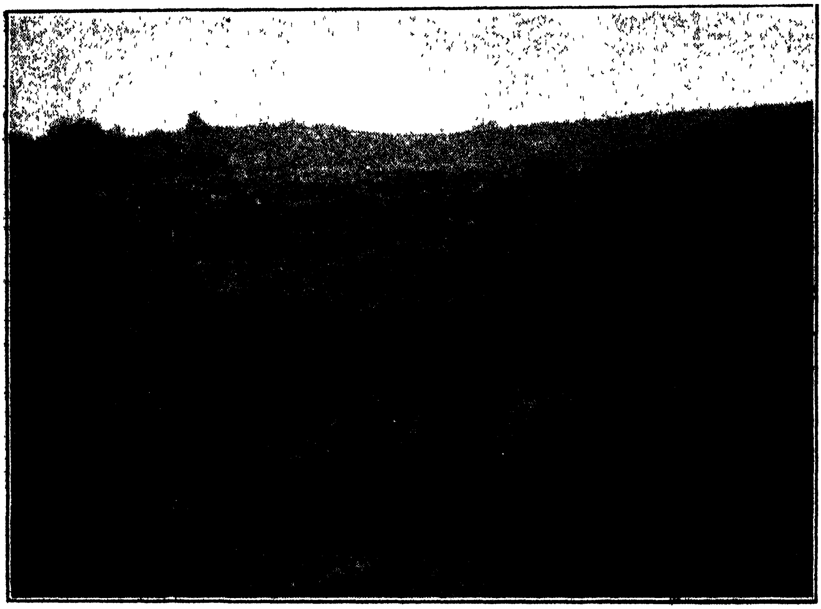

FIG. 5. ROLLING, RED HILL SANDY LOAM IN NATURAL STATE.

FIG. 6. MARRAM-GRASS, THREE YEARS AFTER PLANTING, RAPIDLY COVERING A SAND-DRIFT AND CHECKING FURTHER ENCROACHMENT.

FERTILIZERS.

The consolidated sand areas vary in fertility according to type, but are all deficient in phosphate and nitrogen. Poor pasture-swards (Fig. 7), consisting of stunted paspalum, *Lotus hispidus*, brown-top, sweet vernal, tar-weed, and danthonia, cover a large area of the Te Kopuru soil type. These poor pastures respond quickly to phosphatic top-dressing (especially basic slag), while applications of lime also give improved responses when used in addition. The fertility of this soil is extremely low, while the drainage is poor, and even with heavy applications of phosphatic fertilizers and lime it is practically impossible to establish and maintain a high-producing pasture. Top-dressing will, however, improve the existing sward, but it is doubtful if it is a payable procedure.

On the other hand, the Red Hill sandy-loam soil type has good drainage and higher fertility, which makes pasture establishment on this soil type an easier proposition. Considerable areas of this soil type have in past years been burned and surface sown. The resultant pasture-sward (Fig. 8) has been neglected, and the sward now consists of ratstail, danthonia, suckling clover, catsear, and in places paspalum—a very poor unpayable type of sward, for on this land a first-class pasture consisting of perennial rye-grass, white clover, cocksfoot, and paspalum can be established and maintained provided the necessary precautions regarding good cultivation, sowing good strains of permanent grasses, and using adequate supplies of phosphate are taken.

Fertilizer experimental work in pasture top-dressing carried out on these soils has given the following results :—

Experiment No.	Soil.	Responses to Fertilizers 0, no response; 1, slight; 2, fair; 3, good, 4, very good; 5, excellent.						
		Superphosphate	Lime	Potash.	Superphosphate plus Lime.	Superphosphate plus Lime plus Potash.	Slag.	Slag plus Lime.
16/1/226 ..	Red Hill sand..	4	1	0	4½	4½	..	..
16/1/227 ..	Red Hill sand..	3	0	0	3½	3½	..	..
16/1/228 ..	Red Hill sand..	4	1	0	5	5	..	..
16/1/229 ..	Red Hill sand..	4	0	0	4	4	..	..
16/1/98 (D)	Te Kopuru sand	2	1	0	3	3	3	4

Experiments 16/1/226, 227, 228, and 229 were laid down during the autumn of 1933; at laying-down, plots received lime at 1 ton per acre, superphosphate at 3 cwt., and 30 per cent. potash salts at 2 cwt. per acre. At the end of two years and a half, fertilizer responses on Red Hill sand show an excellent response (Fig. 9) to superphosphate, a slight additional benefit for lime when used with superphosphate and no response for potash.

Experiment 16/1/98 (D) was laid down in July, 1929, and kept under observation until June, 1933. In this experiment basic slag and rock phosphate were used in addition to superphosphate. At

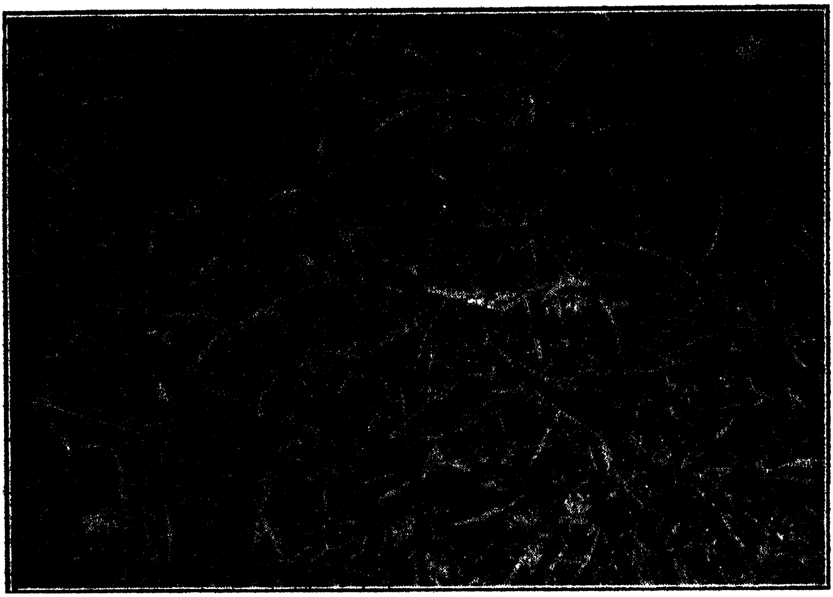

FIG. 7. PASTURE-SWARD COMMONLY SEEN ON PODSOLIZED TE KOPURU SAND.

Stunted paspalum, *Lotus hispidus*, sweet vernal, suckling clover, and catsear. Note sweet vernal in flower. Photo taken 18/10/35.

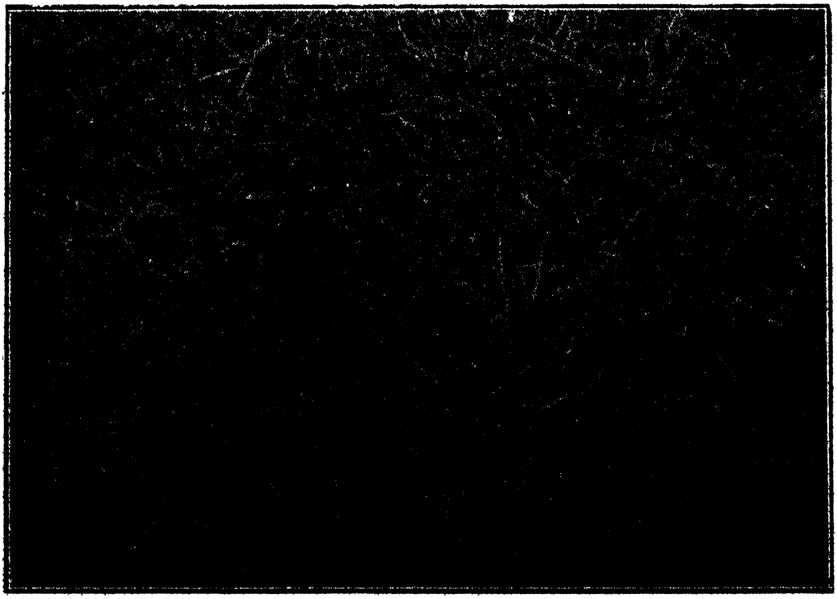

FIG. 8. TOP-DRESSED ORIGINAL PASTURE ON RED HILL SAND SURFACE-SOWN AFTER BURNING.

Sward improves in colour, suckling clover comes in, and photo shows resultant sward, which consists of ratstail, danthonia, suckling clover, catsear, and sorrel—a very poor low-producing sward.

the end of four years fertilizer response on Te Kopuru sand show an outstanding response for basic slag plus lime, whilst basic slag alone was equal to superphosphate plus lime. Superphosphate alone gave a disappointing response, while no response was given for potash.

Superphosphate on the Red Hill sand and basic slag on the Te Kopuru sand appear to be the best types of phosphate, while a good establishment of white clover is necessary to supply the nitrogen. The experiments show that there is a general lack of response to lime alone, but lime gives an increased response when used in addition to superphosphate and basic slag.

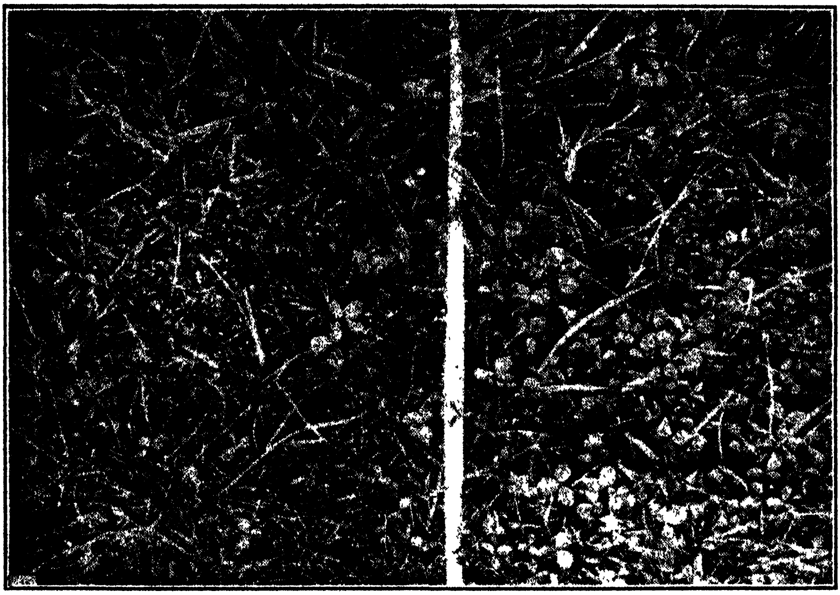

FIG 9. SUPERPHOSPHATE MAINTAINS AN EXCELLENT PASTURE SWARD ON RED HILL SAND.

Pasture was sown autumn, 1932, both plots received same treatment at laying-down. Right-hand portion of picture has been top-dressed annually with superphosphate at 3 cwt. per acre; left-hand portion shows rapid deterioration taken place after discontinuing annual applications of superphosphate for two years—white clover is being replaced by suckling clover, rye-grass is becoming open and lacking vitality.

GRASSING.

The areas of Red Hill sand, being younger, have not been leached to the same extent as the Te Kopuru sand. They make good dairying land and are being fairly rapidly developed for this purpose. The soil is light, not very well supplied with humus, and the development into high-class dairying pastures requires careful cultivation aiming at a good firm seed-bed, followed by adequate phosphatic manuring. Grassing can be done in three ways :—

(1) After clearing and burning, the land can be lightly surface-cultivated and a cheap temporary pasture-mixture consisting chiefly of *Lotus hispidus* can be sown. This temporary pasture builds up fertility and makes subsequent permanent grassing easier.

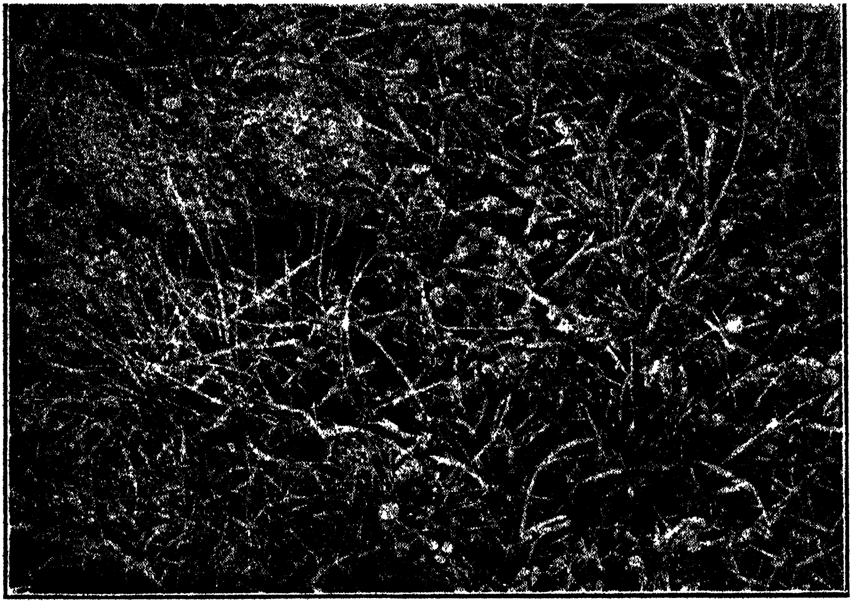

FIG. 10. THE SEED-BED MUST BE CONSOLIDATED FOR GOOD WHITE-CLOVER ESTABLISHMENT.

Picture shows establishment of pasture on Red Hill sand six months after sowing. Right-hand portion shows good establishment on a consolidated seed-bed, while poor establishment, especially clover, is seen on the left-hand portion of the picture where consolidation is poor.

(2) After clearing and burning the land can be ploughed, sown in permanent grass, and fertility raised by heavy applications of phosphates. This method is dependent on a good initial strike of white clover—further phosphates encourage the clover and the clover in turn encourages the grass. For this method to succeed it is necessary that the land be ploughed early, cultivated thoroughly throughout the summer months to a firm seed-bed, and the grass and clover sown early in the autumn so that plants become well established before the cold winter westerly winds start to blow.

(3) After clearing and burning, the land can be ploughed during the late autumn or early winter and then sown in root crops, such as soft turnips, for summer feeding. Here, again, it is necessary to raise the fertility for successful permanent pasture establishment by good cultivation and heavy applications of phosphatic fertilizers. This method is perhaps the most economical—the Red

Hill sand grows excellent root crops, and soft turnips are very valuable for feeding to the dairy stock from Christmas on through the summer months, when the pastures generally dry up through the inability of the soil to hold moisture.

Cultivation is important. A good seed-bed for grass is clean, sweet, moist, fine, and firm at the time of sowing. The seed-bed must be consolidated from below up (Fig 10).

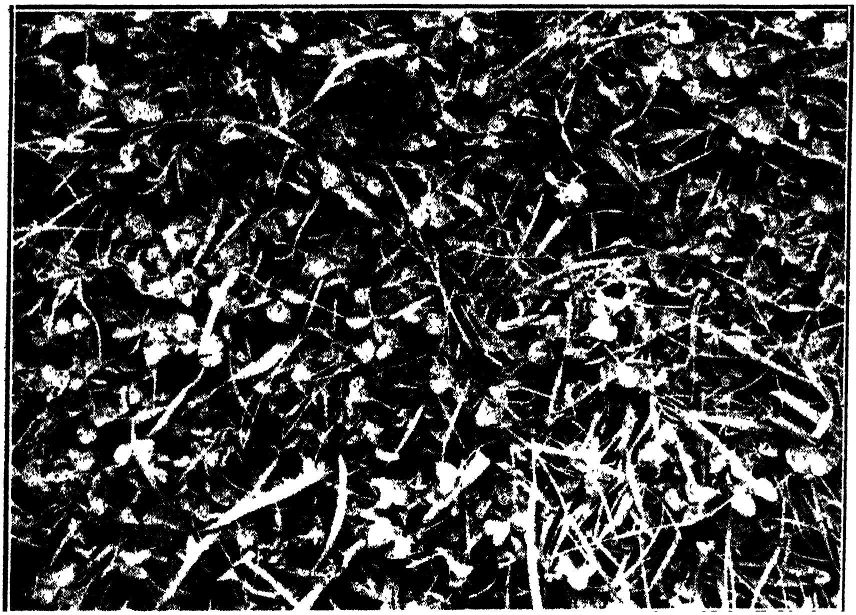

FIG. 11. PASPALUM - SUBTERRANEAN-CLOVER PASTURE WITH A LITTLE RYE-GRASS ON RED HILL SAND

An excellent association where rye-grass is difficult to establish and maintain.

Experience has shown that the most suitable cultivation for this sandy land preparatory to grass is to plough with a lea mouldboard plough, 6 in. deep (the better the ploughing the easier it will be for the subsequent work of seed-bed preparation). The soil should be fallow for at least four or five months to allow of weathering and good aeration, and for the furrow-slices to close together. It is advisable to roll on the furrow with a Cambridge roller, to double disk to a fine seed-bed, followed by the tyne or chain harrows to level the surface. It should be rolled before sowing the seed and fertilizer, and the seed covered with light chain harrows and finally rolled again.

Ploughing with a lea or long mouldboard plough is preferable to doing the work with a plough of the digger mouldboard type, as, with the former, subsequent consolidation is easier. Rolling on the furrow with the Cambridge roller is most important; rolling should be done in the direction of the ploughing, and the heavier the roller the better. This rolling consolidates the bottom of the seed-bed, and brings the soil moved by the plough in close contact with the unmoved subsoil, making a continuous firm layer of soil through which soil moisture may move from the deeper layers to the surface.

There are two main types ot pasture established on the consolidated sand areas, viz. :—

(1) A paspalum - subterranean-clover pasture :
(2) A rye-grass - cocksfoot - paspalum - white-clover pasture.

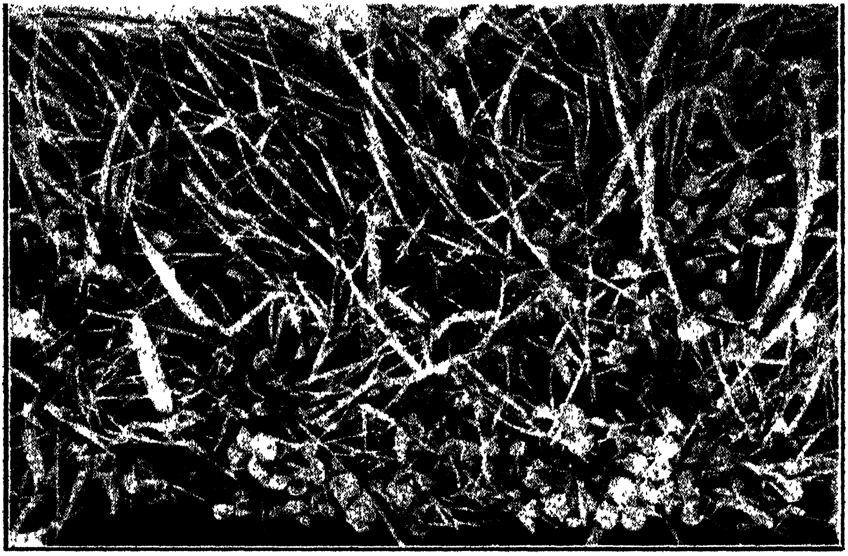

FIG. 12. RYE-GRASS - COCKSFOOT - WHITE-CLOVER - PASPALUM PASTURE

The ideal type of pasture-sward which is growing vigorously on the Red Hill sand areas. Pasture sown March, 1933, had adequate phosphatic top-dressing during the first year, and has been top-dressed annually with 3 cwt. superphosphate each autumn. Photo taken 16/10/35.

The paspalum - subterranean-clover pasture (Fig. 11) is found where farming is carried out on extensive rather than intensive lines and where only light top-dressing is practised. It is an excellent association where rye-grass is difficult to establish and maintain. Paspalum has good summer growth, whilst subterranean clover is an annual. It buries its own seeds, and the young plants live up to February–March. They grow well in the autumn, winter, and spring, grow vigorously in October, November, and December, and then wither and die. This association appears to be more suited to the Te Kopuru sands ; it is fairly easy to establish, but the growth from subterranean clover is not very great on this poorly drained soil type. White clover is difficult to establish and maintain, and subterranean clover with *Lotus hispidus* and suckling clover forms a good companion for paspalum.

The rye-grass - cocksfoot - white-clover - paspalum pasture (Fig. 12) is found growing vigorously in the Red Hill sand soil type. A consolidated seed-bed (Fig. 13) with heavy phosphatic top-dressing is necessary to raise the fertility to a level required by rye-grass. The mixture sown to produce the sward illustrated in Fig. 12 consisted of—certified perennial rye-grass, 25 lb.; paspalum, 5 lb.; cocksfoot, 5 lb.; crested dogstail, 3 lb.; red clover, 2 lb.; and certified white clover 2 lb. per acre. The whole success of sowing this mixture depends on using certified perennial rye-grass and certified white-clover seed. Before certified rye-grass and white-clover seed was available it was impossible to establish on these soils a dominant rye-grass pasture, for the short-lived strains of rye-grass "went out" very rapidly. Heavy phosphatic manuring is also required—at least 3 cwt. of superphosphate per acre should be applied with the seed, followed by another dressing of 3 cwt. per acre three or four months later, and thereafter a dressing of superphosphate should be applied each autumn at the rate of at least 3 cwt. per acre. Treated in this way the pastures are capable of a butterfat-production of up to 150 lb. per acre. Early sowing is also most important. This is a rule which can be adhered to for most soil types—do not wait for rain before sowing, this is not necessary if cultivation has been done thoroughly; for good pasture establishment sow while the surface soil is dry, or when a cloud of dust is following the harrows.

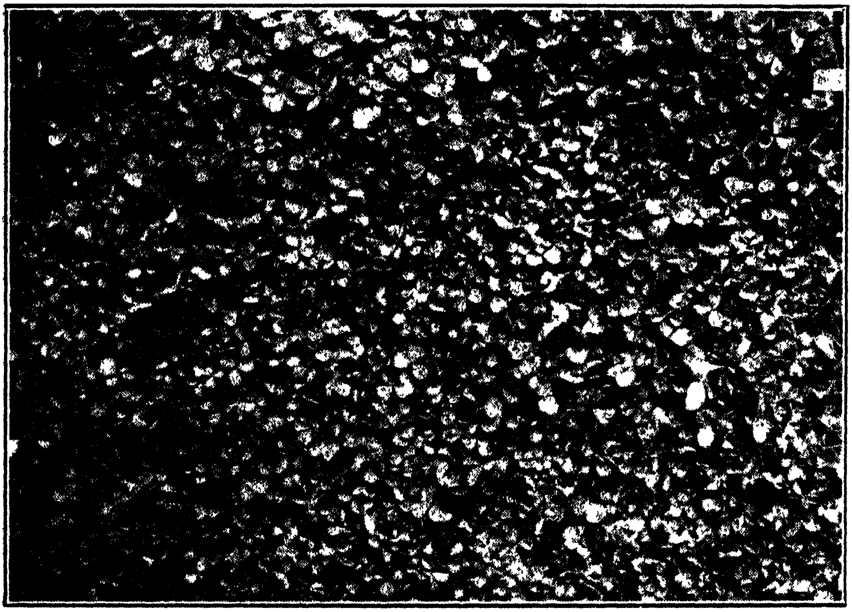

FIG. 13. DOMINANT WHITE-CLOVER SWARD

Sown with same mixture and same time as Fig 12, but in an unconsolidated seed-bed. White clover failed to strike in loose seed-bed, rye-grass and other species came through, but failed to exist without white clover; during the second year, when natural consolidation took place, white clover came away rapidly, resulting in a mat of dominant white clover.

DEVELOPMENT.

During the summer of 1932 two large blocks of Red Hill sand areas were purchased by the Government and settled with unemployed married men under the Small-farm Scheme. The blocks are shown on the plan (Fig. 1) as Wilson's and Bassett's blocks. Wilson's block consists of twenty-one sections, and is situated on the west coast about nine miles from Dargaville, while Bassett's block, which consists of eleven sections, is situated farther south, about sixteen miles from Dargaville. Each section on both blocks consists of approximately 50 acres. Development work was carried out on these blocks during the autumn of 1933. The results have exceeded all expectations, and the areas dealt with are now carrying an excellent sole of grass consisting mainly of rye-grass, cocksfoot, and white clover. The growth of grasses and clover has been so vigorous that paspalum has had little chance to establish (Fig. 14).

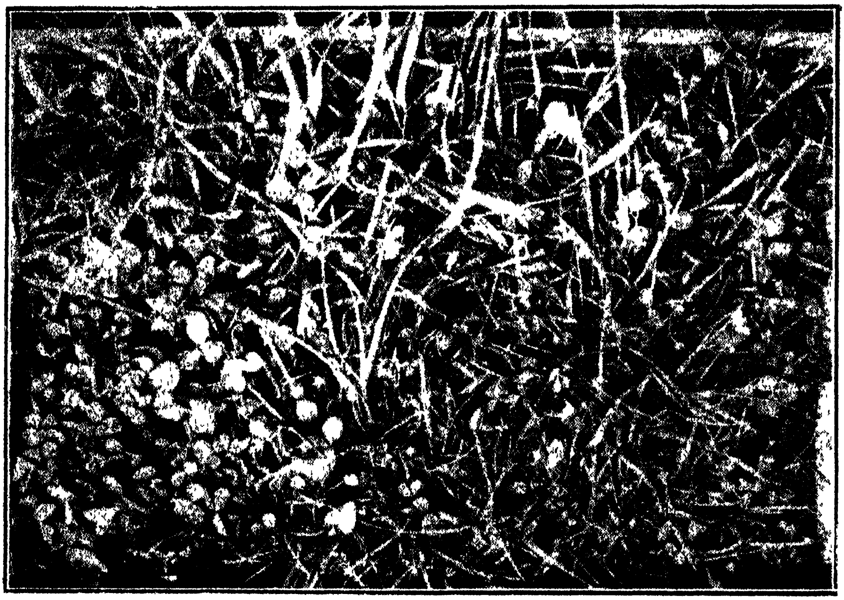

FIG. 14. RYE-GRASS-WHITE-CLOVER-COCKSFOOT SWARD.

Another example of a good sward on Red Hill sand. Paspalum is being crowded out by the vigorous growth of other species.

The carrying-capacity of these small farms is increasing rapidly, and the sections are now carrying up to thirty milking cows producing up to 7,500 lb. of butterfat on the better sections.

Subsequent management is along similar lines to other grassland—with heavy stocking and regular manuring, fertility is raised, more stock means more manure, more manure means more grass, and more grass means more live-stock can be carried.

The Red Hill sand can be developed fairly cheaply. The scrub covering is light, and if burnt off two years ahead of ploughing the cost of clearing is negligible. Cultivation, allowing full costs for labour and feed, costs £2 to £2 10s. per acre, grass-seed £1 10s. to £1 15s. per acre, fertilizer about £1 10s. per acre, fencing for fully developed farms £2 to £3 per acre, water £1 10s. to £2 per acre. This latter cost is most difficult to assess, as the land is naturally watered by creeks or lakes. Water generally has to be pumped to a higher level and then reticulated over the farm by gravitation. On Wilson's and Bassett's blocks a large engine and pump have been installed. The water is pumped into a large reservoir placed on a high hill, from there it runs to each farm--drinking-troughs are placed in the various paddocks, and an ample supply reaches each section by gravitation.

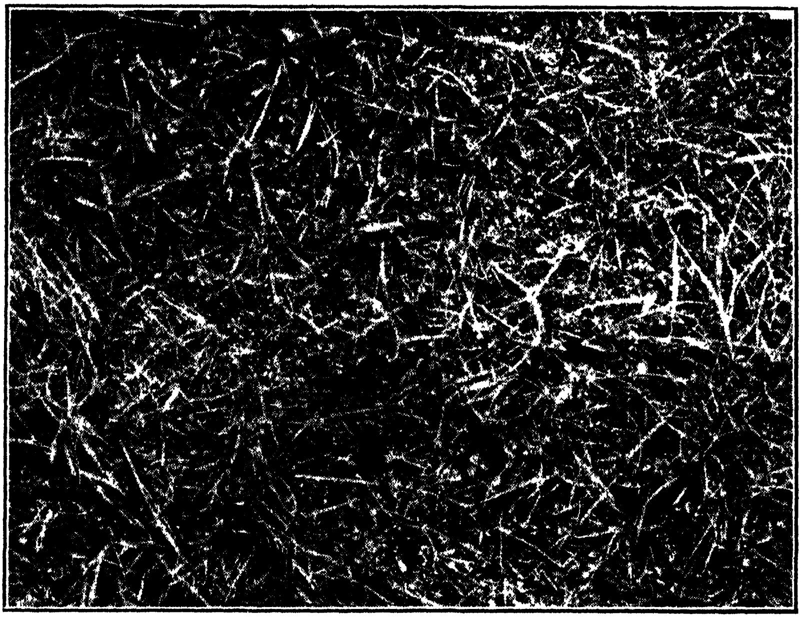

FIG. 15 PHOSPHATIC TOP-DRESSING IS ESSENTIAL TO MAINTAIN WHITE CLOVER IN THE SWARD

White clover practically all replaced by suckling clover through lack of phosphatic top-dressing. Sown with the same mixture and at the same time as Fig. 12.

When developed and sown with good types and strains of permanent grasses and clovers the Red Hill sand areas should be useful country for fat-lamb raising and dairying. Recent work has proved that good high-producing pastures can be established now certified grass and clover seeds are available. The country generally consists of easy undulating hills, which can be easily ploughed. Not far removed from the sea-coast, it is situated in an excellent position when the health of sheep and cattle has to be considered. The land is healthy in winter and summer, gives a good winter growth—although it may become somewhat dry during the summer months—it is well watered with lakes, and is easy to road.

Cultivation is easy and excellent root crops can be grown. Rape can be grown successfully, and a large area of the country gives one the impression that it would be excellent sheep country, especially for fat-lamb raising.

ACKNOWLEDGMENTS.

The writer wishes to thank Dr. H. H. Allan, of the Plant Research Bureau, Palmerston North, for the assistance he gave in identifying the plants found growing on the consolidated sand areas.

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COBALT-FEEDING EXPERIMENT AT AROHENA.

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In the latter part of 1936 an attempt was made to get representative farmers on the different volcanic showers of the centre of the North Island where bush sickness exists to carry out drenching trials with cobalt. This was considered necessary in order to find out whether there was a response to cobalt in the North Island similar to that found by workers of Cawthron Institute in the South Island at Glenhope.

Farmers in all areas where bush sickness was known to exist in cattle or sheep had become accustomed to feeding out limonite-salt licks, and on this account were rather loath to undertake the additional work which a drenching experiment would entail. An experiment became possible in two areas, however, the one the Government farm at Mamaku and the other the property owned by Mr. A. R. Weal, Arohena. Mamaku experiments are not yet sufficiently advanced to report. These two farms represented two different volcanic showers, that at Arohena being on the large Taupo shower. Mr. Weal, who had had considerable trouble with bush sickness in his sheep in the past, very kindly offered to place ewes with lambs at the disposal of the Department of Agriculture and to carry out the necessary drenching of the sheep and lambs.

Four groups were decided upon :—

(1) Four ewes to be dosed twice weekly with 3·5 c.c. of a solution of cobalt sulphate at the rate of 1 mg. of the cobalt salt per day; four lambs to receive 3·5 c.c. of the same solution once a week.
(2) Four ewes to be drenched with a solution of similar strength weekly, in doses of 7 c.c.; four lambs to receive 3·5 c.c. once weekly.
(3) Four ewes to be dosed once a month with 30 c.c. of the stock solution, while four lambs received 15 c.c. once a month.
(4) Nine ewes and nine lambs to be left as controls.

All sheep were to be weighed once a month, and the state of health noted. Examination of blood-samples was, unfortunately, not possible, because of the difficulty of obtaining samples and getting them to a laboratory.

Weights in pounds were obtained as follows :—

—	13/11/36	15/12/36.	15/1/37	16/2/37.	17/3/37.	16/4/37.
Lot No. 1 . 4 Ewes, 4 Lambs						
Ewe—						
No. 604	129	135	131	137	143	126
No. 606	139	145	140	142	151	159
No. 608	119	126	122	132	138	138
No. 610	154	140	126	131	139	142
Average weight ..	135·25	136·5	129·75	135·5	142·75	141·25
Lamb—						
No. 605	36	51	61	72	80	88
No. 607 .. .	35	47	66	81	88	84
No 609 .. .	16	21	34	43	49	53
No 611	29	42	55	58	73	81
Average weight ..	29	40·25	54	63·5	72·5	76·5
Lot No 2 : 4 Ewes, 4 Lambs						
Ewe—						
No. 612 .. .	114	124	118	148	134	144
No. 614 .. .	115	123	98	110	122	128
No. 616	128	142	121	130	141	141
No. 618	136	131	136	135	142	146
Average weight ..	123·25	130	118·25	130·75	134·75	139·75
Lamb—						
No 613	31	40	58	70	74	81
No 615	25	39	55	65	70	77
No. 617	28	43	61	78	82	87
No. 619	19	Dead	..	..	..	..
Average weight ..	25·75	40·7	58	71	75·3	81·7
Lot No. 3 : 4 Ewes, 4 Lambs.						
Ewe—						
No. 620	121	128	113	118	122	130
No. 622	113	125	109	111	117	120
No. 624	118	118	105	102	103	100
No. 628	123	126	107	81	Dead	..
Average weight ..	118·75	124·25	108·5	103	114	116·7
Lamb—						
No. 621	38	59	76	80	79	80
No. 623	39	53	59	65	60	63
No. 627	22	28	35	34	35	40
No. 629	27	44	57	60	54	53
Average weight ..	31·5	46	56·25	59·75	57	59

—		13/11/36.	15/12/36.	15/1/37.	16/2/37.	17/3/37.	16/4/37.
			Lot 4: 9 Ewes, 9 Lambs.				
Ewe—							
No. 630 ..	..	150	142	121	125	117	108
No. 632 ..	..	138	144	121	121	131	125
*No. 634 ..	..	118	100	90	88	85	88
No 636 ..	..	138	152	133	130	139	128
*No. 638 ..	..	128	111	92	93	93	99
No. 640 ..	..	118	104	Missing	..	..	..
*No. 642 ..	..	93	87	76	88	92	93
No. 644 ..	..	86	79	86	Missing	..	..
*No. 646 ..	..	89	83	68	69	80	81
Average weight	..	117·5	112	98·4	102	105·3	103·1
Lamb—							
No 631 .	..	15	21	Dead	..	..	..
No. 633 ..	..	37	52	66	63	60	60
†No. 635 ..	..	24	29	20	Dead	..	..
No. 637 ..	..	35	53	62	71	73	70
†No. 639 .	..	19	21	25	27	30	31
†No. 641 ..	..	25	32	37	43	42	47
†No. 643 ..	..	31	33	32	28	Dead	..
No 645 ..	..	17	Dead	.	..	.	..
No 647 ..	..	22	29	28	31	32	35
Average weight	..	25	33·7	38·6	43·8	47·4	48·6

* Dosed on 15/1/37, 16/2/37, 17/3/37, and 16/4/37 with 30 c.c. cobalt owing to their showing signs of weakening.

† Dosed on 15/1/37, 16/2/37, 17/3/37, and 16/4/37 with 15 c.c. cobalt owing to their showing signs of weakening.

DISCUSSION.

The first two groups of ewes did well, and were at the last weighing in splendid condition. Their lambs also put on weight, and, except for the unaccountable death of lamb 619 after the first weighing, are in good order.

The third group, where monthly dosing was carried out, did not do nearly so well. One ewe died, but not from bush sickness, while the lambs put on weight slowly. This group is intermediate in appearance between the first two and the last.

The fourth group did badly, two ewes and four lambs dying. Others, which were getting extremely weak, were dosed with cobalt to save their lives. These are marked in the table. In appearance the group is very poor, and if cobalt had not been given the majority would have died.

The experiment has shown that cobalt is efficacious in preventing bush sickness in the Arohena district if given at regular intervals of once or twice a week. From previous work on elimination of the metal carried out by Askew and Josland, the optimum period for drenching has been shown to be twice a week, but with the amount given in this trial dosing once a week was quite sufficient. Dosing once a month was tried out because of the fact that some farmers have been giving large doses of 500 mg. and more at long intervals. Group three shows that the practice of dosing at intervals of a month is not sufficient to keep lambs growing at an optimum, although they remain healthy.

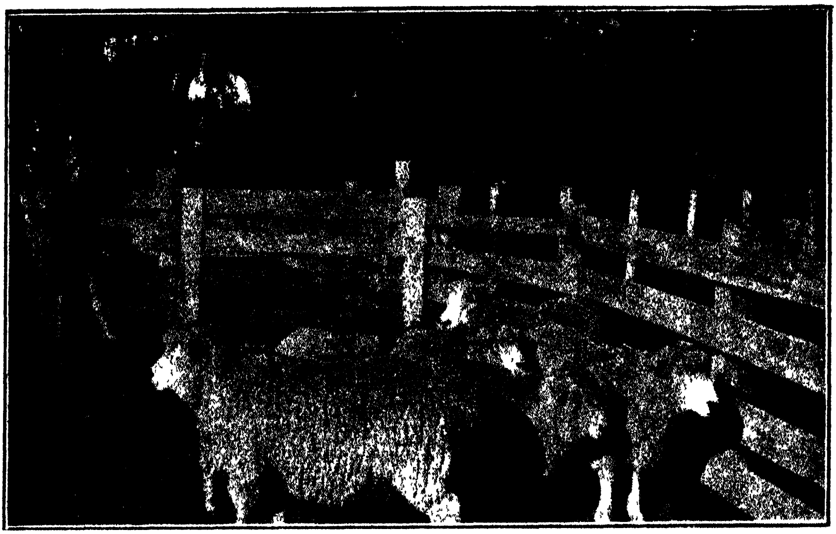

FIG. 1. LOT 1: DOSED WITH 5 C.C. OF COBALT SOLUTION TWICE WEEKLY.

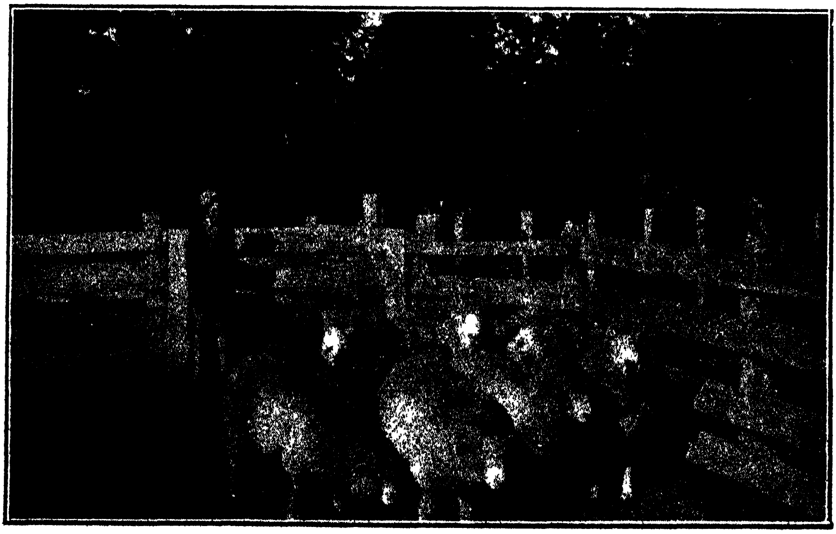

FIG. 2. LOT 2: DOSED WITH 7 C.C. OF COBALT SOLUTION TWICE WEEKLY.
One lamb in centre of this lot belongs to Lot 1.

FIG. 3. LOT 3: DOSED WITH 30 C.C. OF COBALT SOLUTION TWICE WEEKLY.

FIG. 4. CONTROL LOT.

It should be pointed out that, although drenching with cobalt has been tried experimentally, it is not a practical method of control of bush sickness, as the labour involved is irksome and impossible when numbers of sheep have to be kept in health. The training of sheep and cattle to take limonite licks of high cobalt content is, as yet, the only practical means of controlling the mortality.

The thanks of the author are due to Mr. A. R. Weal, who made the experiment possible, and to Mr. G Melrose, Inspector of Stock, Te Awamutu, who weighed the sheep and supervised the experiment carefully and who supplied the photographs.

BIENNIAL CROPPING OF APPLES.

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IN the fruit industry to-day it is widely recognized that a high level in production is desirable. Furthermore, it is also realized that fluctuations in crop totals from year to year have a decided detrimental effect upon the stability of markets, and finally upon the grower's net return. In consequence it is the endeavour of most orchardists to secure consistent rather than spasmodic crops

Biennial cropping, by which is meant the tendency of a fruit-tree to bear a heavy crop every alternate year and light crops in the intervening years, is probably the greatest factor against securing consistent crops.

Many varieties of apples, principally those which are spur bearers, are affected by biennial cropping. This habit may first be brought about by any factor, natural or otherwise, which causes an exceptionally heavy crop in any year. Once the natural balance has become upset the cycle of biennial cropping quickly becomes established, and careful treatment is required to correct the trouble and again bring about average annual crops.

To understand corrective treatment better a grasp of the causes underlying the cycle of biennial crops is desirable.

When the tree carries an exceptionally heavy crop, one which is beyond its normal capacity, the phenomenal demand made by the growing fruit seriously depletes the elaborated sap-supply, and results in the semi-starvation of the developing fruit-buds. Consequent upon this semi-starvation, the majority of the fruit-buds remain undeveloped and fail to produce fruit the following season.

During the season of the light crop the surplus of elaborated sap produces excessive bud-development, with a consequent heavy crop the following season, and so the cycle continues.

The apparent limiting factor is that of elaborated sap. This may be caused by a lack of an adequate and available food-supply to the roots, or by insufficient leafage to elaborate the available sap, or by both of these. The spur-bearing varieties, apparently because of their sparse leafage, are more prone to be thrown out of balance by a heavy crop.

In a previous article on this subject entitled " Biennial Bearing in Apple-trees " (this *Journal*, Vol. 44, No. 17, pp. 38–41), the writer discussed methods of overcoming the biennial-cropping habit, and the following observational experiment which was carried out amply supports the contention that this unfavourable aspect of fruitgrowing may be overcome. The observation was made possible by the ready co-operation of Mr. W. J. McMiken, of Hamilton, who carried out the suggested treatment in his orchard, and later adopted the practice generally on apple-trees in his orchard.

The variety, Dunn's Favourite, was selected for the purposes of the observational test, because it is considered to be one of the varieties most prone to be thrown out of consistent cropping.

The particular trees were planted in 1914, and were well grown, being approximately 12 ft. to 14 ft. high and having a 14 ft. spread. The average number of leaders on a tree was in the vicinity of twenty-four. At the commencement of the observations the trees were heavily laden with short fruit-spurs, while practically no lateral growth was to be found. The trees had a rather exhausted and stagnant appearance.

Over the previous few years the crops were estimated by Mr. McMiken as being from 3 to 5 bushels in the " light " years and from 14 to 16 bushels in the " heavy " years.

Annual manuring had been carried out, the trees receiving approximately 3 lb. of superphosphate and 2 lb of bonedust each. Green manuring with blue lupins had also been commenced in 1928.

The method of improvement was by (1) increased manuring, continued growing and ploughing under of green crops, and by (2) an improved system of pruning.

In the winter of 1930 a heavy reduction was made in the number of spurs carried by the trees, approximately 50 per cent. being cut away, and a commencement made in the reduction of the number of leaders by thinning out from three to four in each tree. The manuring was increased by 1 lb. of superphosphate per tree.

The following season was the " light " year, and a large amount of new lateral growth was produced. In the winter this new growth was left uncut, while a further inroad was made into the remaining old spurs, and approximately 20 per cent were removed. The leaders were reduced in most of the trees by a further two. The manuring was increased to 8 lb. per tree, comprising 6 lb. of superphosphate and 2 lb. of bonedust.

The second season was due in the cycle as a " heavy " year. With the heavy thinning of the fruit-spurs, followed by a heavy thinning of the fruit, the crop was reduced and approximately only 10 bushels per tree were carried. Extensive new lateral growth was made, while a heavy development of fruit-buds took place on the previous year's uncut laterals. At the winter pruning approximately 30 per cent. of the remaining old spurs were cut away, and all new growth, except where crowding, was left intact. The leaders were again slightly reduced in numbers.

In the summer of 1933 the trees now presented quite a different appearance, being liberally furnished with new lateral growth. The development of healthy buds had been extensive, and the promise was for a heavy crop in what would, in the old cycle, have been a " light " year. In the manurial programme an increase to 10 lb. per tree was made, which consisted of sulphate of ammonia 1½ lb., superphosphate 6 lb., and bonedust 2½ lb.

The following season turned out to be one of heavy crop, close on 20 bushels per tree being produced. The majority of the fruit was now being carried on the lateral wood. Despite the heavy crop new lateral growth was satisfactory.

Since then, with the exception of one year when a late frost lowered the crop, cropping has been consistent, and this season sees the fourth consistent crop of over 20 bushels per tree.

Each winter the pruning has been on the same basis, that of cutting away the old and exhausted wood, and leaving the new lateral growth to take its place in the sequence of fruiting. The provision of lateral growth has provided the tree with increased leafage, and the benefit is to be seen in the healthy rejuvenated appearance of the trees.

The manuring has been gradually increased, sulphate of potash being added in 1934 and since. Carbonate of lime, 12 cwt. to the acre, was applied in June, 1935. Last year's manuring consisted of 15 lb. per tree applied in August of a mixture containing fish manure, bonedust, and sulphate of potash at a ratio of 2 10-3, and in October with 4 lb. per tree of meat-meal.

As a result of this season's satisfactory crop, together with further satisfactory new lateral growth and good fruit-bud development, it is considered that these trees have now been established in consistent cropping.

Other biennial cropping varieties in the same orchard appear to have responded in a like manner, and have reverted to annual average cropping.

In orchard practice it must be recognized that increased quantities of manure at times must be applied if heavy crops, together with sufficient new growth, are to be maintained. Increased manuring, however, will not correct biennial cropping or maintain consistent crops unless it is associated with the correct pruning practice. Briefly put, this consists, in the case of all apple-trees, of the removal each winter of the older and more exhausted fruiting-wood, and the spacing and leaving unshortened of all one-year-old lateral growth.

At a large meeting of farmers at Rakaia in May a discussion took place regarding the growing of blue lupins for sheep-feed. There was great diversity of opinion, but the majority state that lupins were not good sheep-feed and that stock had to be starved before they would eat the lupins. -*Fields Superintendent, Christchurch.*

Certified White Clover in Canterbury. -In the Rangiora district the common method of establishing mother-seed white-clover areas is to broadcast 3 lb. to 4 lb. of seed on an autumn-sown wheat crop. The white clover is sown in the spring after the wheat has been rolled, and light harrows are used to cover the seed. Although this is natural white-clover country, some of the stands have been almost complete failures this year. Heavy wheat crops have sometimes resulted in poor clover establishment. Rather than incur the expenses of preparing the land for spring sowing along with rye-grass, most farmers prefer to risk sowing the high-priced clover-seed with wheat. In one or two cases certified Hawke's Bay rye-grass has been sown with the clover and certified seed of both plants harvested off the same area. Probably the reason for the popularity of sowing with wheat is the excellent manner in which red clover has at times been established. Red clover, however, is more suitable for this practice than white clover, as its upright habit enables it to withstand the shading better, and the deeper rooting-system of red clover enables it to withstand better a dry period, after the wheat has been removed and has left the land depleted of moisture.—*Instructor in Agriculture, Christchurch.*

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1936–37.

Provisional certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certification tags to be attached to the sacks are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes and is satisfied that they are still of the same standard of purity and freedom from disease as was indicated by the field inspection.

Each crop has received a group-number, which indicates as accurately as possible the merits of its produce for seed purposes in relation to the merits of the produce of the other provisionally certified crops of the same variety. Group 1 is the highest and Group 9 the lowest. The difference between any two consecutive groups is small, and in making comparisons the cost of seed and transport should receive consideration.

Crops are also divided into two classes—namely, (1) certified " mother " seed; (2) certified " commercial " seed. Areas sown with certified mother seed are eligible for entry into certification. Areas sown with certified commercial seed are not eligible for entry into certification, except in the case where the seed planted has been raised by the entrant (grower) himself. Growers who intend to purchase seed with the object of entering certification must therefore purchase certified mother seed.

LIST OF GROWERS

Name and Address.	Group No	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP.			
Mother Seed (Canterbury and Marlborough)—			
Acland, L. G. D., Hororata	3	..	1
Adams Bros., Sheffield (Line A)	3	..	9
Aker, H. W., Hawthornden Road, Upper Riccarton	3	0·2	3
Aymes, H. C, " Riversleigh," Annat	3	..	3
Anderson, A, " Crofthead," Southbridge	3	0·2	9
Annett, C., St. Andrews	2	..	1½
Baker, S., R.M.D., Tycho	3	..	1
Barclay, G. M. M., Riverlands, Waimate (Line B)	3	..	1
Barnes, R., John's Road, Belfast	3	0·5	1
Barnett, R., Dunsandel	3	..	4
Barr, H. C., Springston, R.D.	3	0·3	3
Bennett, R. R., Eyreton, Kaiapoi, R.D. (Line A)	3	..	2
Biggs Bros., Tycho, Timaru	3	..	1½
Black, D. C., Gleniti, Timaru	2	0·2	1
Botting, A. R., Factory Road, Temuka	3	..	1
Boyce, W. J., Waituna, Waimate	2	..	1
Boyle, A. D., Orari (Line B)	3	..	1
Breakwell, A J., Tinwald (Line C)	2	..	4
Brodie, R., Rangitata Island (Line A)	3	..	1½
Brodie, R., Rangitata Island (Line B)	3	..	1½
Brown, G. E., Kaiapoi, R.M.D. (Line A)	2	..	2
Burnett, W. J., Mina, North Canterbury	2	..	1
Caldwell, G. D., 145 Russley Road, Christchurch (Line A)	3	..	1
Caldwell, G. D., 145 Russley Road, Christchurch (Line B)	3	..	1
Caldwell, G. D., 145 Russley Road, Christchurch (Line C)	3	..	3
Campion, C. A., Mount Hutt, R.D., Rakaia	3	..	3
Carr, J., Mount Hutt, R.M.D., Rakaia	3	..	1½
Carroll, J., Southbridge	2	..	4
Carroll, T. F., Southbridge	3	..	7

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued*			
Mother Seed (Canterbury and Marlborough)—continued			
Cashion, J. J., 168 Yaldhurst Road, Riccarton	3	..	1
Chappell, L. J., Killinchy, Leeston, R.M.D	3	..	1
Chappell, T., West Coast Road, Yaldhurst, (Line A)	3	0·2	2
Chatterton, C. S., Dunsandel	3	..	2
Chatterton, W V., Dunsandel	2	..	2
Cherry Bros , Eyreton, Kaiapoi, R.M.D (Line A)	3	..	3
Cook, P. D., Albury (Line A)	3	..	2
Cook, P. D., Albury (Line B)	2	..	2
Couper, R. P , Washdyke (Line A)	3	..	2
Crawford, J A , Yaldhurst	2	.	4
Crawford, R. T., Yaldhurst (Line A)	3	0·5	3
Croft, R., " Glenlea," Amberley	2	..	1½
Cross, A. E., Bennetts, via Rangiora (Line A)	3	..	1
Cross, A. E , Bennetts, via Rangiora (Line B)	3	..	1½
Cross, H. E., Sandy Knolls	3	..	1
Crowe, D. and J , Waimate	3	0·4	1
Crozier, W. J , Mount Hutt, R.M.D , Rakaia (Line A)	2	..	5
Crozier, W J., Mount Hutt, R.M.D , Rakaia (Line B)	2	..	10
Crump, F , Springston, R M D	3	.	2
Currie, W., Winchester	3	..	1½
Curtis, J J , Yaldhurst	3	.	1
Dale Bros., Maungati	3	..	2
Daniel, E , Kingsdown, Timaru	3	..	1
Davidson, J., Oxford Road, Rangiora	1	..	1
Dillon, J G., Courtenay, R.M D	2	..	18
Doyle, P. J., Gleniti, Timaru..	3		1½
Elliott, D., Albury	2	..	1
Everest, care of J. Crozier, Crozier's Road, Christchurch (Line A)	3	0·1	1½
Everest, care of J Crozier, Crozier's Road, Christchurch (Line B)	3	0·3	4
Ford, B. A. C., Greendale, R.M.D. (Line A)	2	..	3
Ford, B. A. C., Greendale, R M D (Line B)	3	0·2	3
Ford, L , Salisbury	3	..	1
Fowler, G. H., Halkett	2	0·8	1
France, D., Levels	2	..	1
Franks, L J., 88 Russley Road, Christchurch, N.W. 3 (Line A)	2	..	2
Franks, L. J., 88 Russley Road, Christchurch, N.W. 3 (Line B)	2	..	4
Franks, L. J., 88 Russley Road, Christchurch, N.W. 3 (Line C)	3	..	2
Frost, C. H., Balcairn P.O. (Line A)	2	..	1
Frost, C. H., Balcairn P.O (Line B)	3	..	1
Gardiner, O. J., Dunsandel, R M D.	2	0·3	2
Gardiner Bros., Upper Waitohi	2	..	1
Gaskell, L., 112 Russley Road, Upper Riccarton	2	0·2	5
Gilbert, D. R., East Oxford	3	0·5	1
Giles, L. W. E., Kaiapoi, R.M.D.	2	..	4
Giles, V. R., Kaiapoi, R.M.D.	3	..	3
Gillett, G. N. H., Koromiko, Marlborough	3	..	1½
Gray, J. L., St. Andrews (Line C)	2	..	3
Gray, P. B., Hadlow, Tycho, R.M.D. (Line A)	2	..	1
Gray, P. B., Hadlow, Tycho, R.M.D. (Line B)	3	..	3

LIST OF GROWERS—*continued.*

Name and Address.	Group No	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed (Canterbury and Marlborough)—continued.			
Gray, R., St. Andrews (Line A)	3	..	7
Gray, R., St. Andrews (Line C)	2	..	3
Green, J., Gleniti, Timaru	2	..	2
Guy, T. A., and E. B., Courtenay, R.M.D.	2	..	6
Hansen, P., Washdyke	3	..	1
Harrison-Wilke, E. L., Courtenay, R.M.D.	2	..	1½
Harvey, W, Willowby, Ashburton (Line A)	2	..	2
Hawkins, A. T., Sheffield, R.M D	2	..	1½
Hayes, G. B, Halkett, R.M.D	2	..	1½
Henderson, G. H., Courtenay, R.M.D	3	0·3	2
Henderson, J. L., Pleasant Point	2	..	1
Inch, H. V, 104 Ryan's Road, Fendalton, N.W 3	3	..	10
Johnston, R. H., Dunsandel	3	..	2
Jowers, G. C., Darfield, R M.D (Line A)	3	..	1
Judson, C J., High Street, Rangiora (Line A)	3	..	4
Judson, C. J., High Street, Rangiora (Line B)	3	..	5
Kavanagh, Mrs. M, 50 Ryan's Road, Upper Riccarton	3	0·5	20
Kelleher, T., Pleasant Point (Line A)	3	..	4
Kelleher, T., Pleasant Point (Line B)	3	..	4
Kelleher, T, Pleasant Point (Line C)	3	..	2
Kennedy, L. J, Postman's Road, Kaikoura (Line B)	3	.	1
Kenyon, F, Oxford Road, Rangiora	3	..	3
King, G. H., West Belt, Rangiora (Line A)	3	..	4
King, G. H, West Belt, Rangiora (Line D)	3	..	1
King, J C., Box 82, Timaru (Line A)	2	..	1
King, W. H., Rosewill, Timaru (Line A)	2	..	1
King, W. H., Rosewill, Timaru (Line B)	3	..	3
Lewis, T. G., Geraldine	3		2
Longman, Mrs. M., Pareora	2		1
Macdonald, A., Buchanan's Road, Sockburn	3	..	1
McLeod, J. A, Tycho	3	..	1
McPhail, W. A., Mitcham, via Rakaia (Line A)	2	..	1
McPhail, W A., Mitcham, via Rakaia (Line B)	2	..	2
McRobb, A., Mount Hutt, R.M.D, Rakaia	2	..	1
Mackle Bros., Kaikoura Suburban	3		1
Markham, C. W., Fairview Road, Timaru	3	.	1
Marshall, D., Killinchy, Leeston, R.M.D.	2	..	14
Marshall, S. A, Tycho, R.M.D. (Line B)	2	..	1
Marshall, W. H., Prebbleton	3	..	5
Meyer Bros., Waimate	2	..	1
Morgan, D, Cheviot, R.M D.	1	..	15
Moriarty, L., Southbridge	3	..	1
Morrison, T. F., Levels Valley	2	..	1
Mortland, Mrs. S., Templeton (Line A)	3	..	6
Muff Bros., Orari	2	..	1
N.Z. Loan and Mercantile Agency, Christchurch (Line C)	3	0·3	4
N.Z. Loan and Mercantile Agency, Christchurch (Line D)	2	..	5
Oakley, H. R., Eiffelton	3	..	4
Oakley, W., Hororata (Line A)	2	..	6
Oakley, W., Hororata (Line B)	3	..	7
Oakley, W., Hororata (Line C)	3	..	13
Oliver, J. O. J., Factory Road, Temuka	3	..	3
Oliver, W. R., Hororata	3	..	2

LIST OF GROWERS—*continued.*

AUCKLANDER SHORT TOP—*continued.*

Mother Seed (Canterbury and Marlborough)—continued.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
Oliver, Mrs. Z. M., Factory Road, Temuka	3	..	1½
Orbell, W. H., Levels	3	..	1
Pascoe, S., Halkett	3	..	20
Patterson, A., East Eyreton, Kaiapoi, R.M.D. (Line A)	2	..	1
Patterson, A., East Eyreton, Kaiapoi, R.M.D. (Line B)	3	..	4
Payne, J., sen., Springston, R.M.D.	2	..	2
Pearcy, R. P. B., Grove, Marlborough	3	..	2
Petrie, H. H., Swannanoa, R.M.D., Rangiora	3	..	1
Petrie, J., jun., Swannanoa, R.M.D.	3	..	2
Petrie, J., sen., Swannanoa, R.M.D.	3	..	6
Phillips, A., Weedons-Springston, R.M.D.	2	..	2
Phillips, W., Springston, R.M.D.	1	..	2
Porter, E., St. Andrews (Line A)	3	..	2
Proudlock, A., East Eyreton, Kaiapoi, R.M.D. (Line A)	2	..	1
Proudlock, A., East Eyreton, Kaiapoi, R.M.D. (Line B)	3	..	4
Purvis, G., Oxford Road, Rangiora (Line B)	3	..	2
Quinn, M. J., Arowhenua, Temuka	3	..	2
Randall, J., Koromiko, Marlborough (Line A)	3	..	1
Randall, J., Koromiko, Marlborough (Line B)	3	..	1
Rapley, G. L., Southbridge	3	..	4
Rathgen, Mrs. I., Killinchy, Leeston, R.M.D.	1	..	5
Redmond, C., Kimberley, R.M.D.	2	..	10
Redmond, W. G., Courtenay, R.M.D. (Line A)	3	..	8
Redmond, W. G., Courtenay, R.M.D. (Line B)	2	..	2
Reid, L., 230 Withells Road, Riccarton	3	..	2
Rice, H., Kaiapoi	3	..	5
Rich, A. J., Kaiapoi, R.M.D. (Line A)	3	0·2	10
Rich, A. J., Kaiapoi, R.M.D. (Line B)	3	..	5
Richmond, W. T., Willowbridge (Line A)	3	..	2
Richmond, W. T., Willowbridge (Line B)	3	..	2
Robinson, L. C., Levels	3	..	1½
Roper, R. S., Halkett	3	0·5	2
Rose, C. F., Hook, R.M.D., Timaru (Line A)	2	..	4
Rose, C. F., Hook, R.M.D., Timaru (Line B)	3	..	2
Rouse, J. F., St. Andrews (Line A)	3	..	2
Rouse, W., St. Andrews	3	..	1
Royds, R. S., 412 Burnside Road, Fendalton, N.W. 1	3	..	13
Ruston, W. J., jun., Gleniti, Timaru	3	..	1½
Sadler, T., Courtenay, R.M.D.	2	..	10
Sauer, J., St. Andrews	3	..	1
Saunders, A. C., 110 Withell's Road, Yaldhurst	3	..	3
Saunders, E. E., Studholme Junction	3	..	2
Schluter Bros., Rangiora (Line A)	3	..	3
Scott, A., Kerrytown (Line B)	3	..	3
Seaton Bros., Courtenay, R.M.D.	2	0·5	3
Shirlow, E., Kaiapoi, R.M.D.	3	0·3	2
Sievwright, R. M., Washdyke (Line B)	3	..	3
Simpson, F. F., Morven (Line A)	3	..	6
Somerville, H. J. R., Box 44, Timaru (Line A)	2	..	3
Somerville, H. J. R., Box 44, Timaru (Line B)	3	0·2	17
Steele and Dawson, care of F. Steele, Fernside	3	..	3
Steele, J., Kimberley	2	0·3	3

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed (Canterbury and Marlborough)—continued.			
Steven, G. H., Rosewill, Timaru (Line A)	3	..	2
Steven, G. H., Rosewill, Timaru (Line B)	3	..	5
Steven, G. H., Rosewill, Timaru (Line C)	3	..	4
Stewart, A., Marsh's Road, Templeton (Line A)	3	..	5
Stewart, A., Marsh's Road, Templeton (Line B)	1	..	5
Storer, G., Halswell	3	0·2	5
Swanson, W., Selwyn	2	..	1½
Taggart, R., Ltd., 79 Middlepark Road, Riccarton	3	0·2	1
Thomas, J. W., Gray's Road, Christchurch, N.W. 3	2	0·2	4
Turner, C. W., Courtenay, R.M.D.	2	0·2	2
Turner, G. A., Courtenay, R.M.D.	3	..	2
Tweedy, S., Dunsandel, R.M.D.	2	..	6
Walker, C. E. (Estate), Christchurch, Greendale, R.M.D.	2	..	4
Walker, W. H., jun., Halkett, R.M.D. (Line A)	3	0·3	2
Walker, W. H., jun., Halkett, R.M.D. (Line B)	3	..	2
Walker, W. H., jun., Halkett, R.M.D. (Line C)	3	..	2
Wallace, D. W., Main South Road, Timaru	3	..	1
Watson, M. E. M., Dunsandel	3	..	2
Watson, R. G., Cust	3	0·8	4
Westaway, R. J., Christchurch, Greendale, R.M.D.	2	..	18
Whearty Bros., Wheatstone, Ashburton	2	..	1
Wilson Bros., Halkett, R.M.D. (Line A)	2	0·5	1½
Wilson Bros., Halkett, R.M.D. (Line B)	1	..	1½
Wilson Bros., Halkett, R.M.D. (Line C)	3	..	10
Wilson Bros., Halkett, R.M.D. (Line D)	3	0·5	2
Wilson Bros., Halkett, R.M.D. (Line E)	3	..	3
Wilson, C. T., Halkett, R.M.D.	2	..	2
Wilson, M., Halkett, R.M.D. (Line A)	2	..	2
Wilson, M., Halkett, R.M.D. (Line B)	3	..	2
Wilson, M. G., Springston, R.M.D. (Line B)	3	0·3	2
Wilson, R. R., Halkett	3	..	3
Wilson, S. M., Sefton, R.M.D.	3	..	6
Wilson, W. A., Halkett, R.M.D. (Line A)	3	..	4
Wright, L. T., Annat	2	0·2	8
Wright, Q. A., Annat (Line A)	2	..	1
Wright, Q. A., Annat (Line B)	1	..	6
Wright, Q. A., Annat (Line C)	3	0·2	8
Mother Seed (Otago and Southland)—			
Miles, A. C., and E., Portbello, Otago	3	..	1½
Scandrett, C., 62 Bowmont Street, Invercargill	2	..	1
Commercial Seed (North Island).—			
Deadman, G. T., Ohakune	5	..	2
Drayton, P., Rangataua	5	..	2
Faull and May, Raetihi	4	..	2
Fetzer, E. L., Ohakune	6	..	3
Foster, E. H., Ohakune	4	..	2
Hing, Jimmie, Ohakune	5	..	1
Hing, Yoi, Ohakune	4	..	6
Holman, A. E., Ohakune	5	..	3
Marshall, F. C., Ohakune	4	..	2
Toland, W. H., Ohakune	4	..	2
Whale, S. D., Ohakune	4	..	1
Commercial Seed (Canterbury and Marlborough)—			
Adams Bros., Sheffield (Line B)	4	0·2	4
Adams, K. and R., Sheffield	4	0·7	7
Alexandre, H., Belfast	4	1·4	10

LIST OF GROWERS—*continued.*

Name and Address.	Group No	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Amor, A. W., Woodend (Line A)	5	1·0	2
Amor, A. W., Woodend (Line B)	5	1·2	1
Arthur, H., Maungati	4	..	1
Banks, H. B., Banks Avenue, Shirley, Christchurch	4	0·2	1
Barclay, G. M. M., Riverlands, Waimate (Line A)	4	0·4	3
Barnes, W., and Sons, 199 Highsted Road, Styx (Line B)	4	1·1	1
Bennett, R. R., Eyreton, Kaiapoi, R.M.D. (Line B)	5	..	1
Berry and Halliburton,, 28 Dundas Street, Christchurch	5	1·0	4
Bockaert, Mrs. J., St. Andrews (Line A)	4	..	1½
Bockaert, Mrs. J., St. Andrews (Line B)	6	..	1½
Bonnett, N. M., Rangiora	5	..	4
Boyle, A. D., Orari (Line A)	4	..	2
Breakwell, A. J., Tinwald (Line A)	5	0·5	3
Breakwell, A. J., Tinwald (Line B)	4	..	7
Brophy, K., Pleasant Point	6	..	1
Brosnahan, Mrs H. (Estate of), Seadown, Timaru	5	0·8	14
Brown, G. E., Kaiapoi, R M.D. (Line B)	4	..	12
Brown, J. L., Washdyke	5	..	1½
Burrell, T. F., Levels	4	0·2	2
Busby, C. V., Kaiapoi (Line A)	6	0·3	1
Busby, C. V., Kaiapoi (Line B)	6	0·5	1
Cague, W., St. Andrews	4	..	1½
Caird, I., Southburn, Timaru (Line A)	5	..	1½
Caird, I., Southburn, Timaru (Line B)	6	..	1
Carroll, F. A., Southbridge	4	..	4
Chambers, A J, Oxford Road, Rangiora	4	..	3
Chappell, T., West Coast Road, Yaldhurst (Line B)	4	0·3	2
Cherry Bros., Eyreton, Kaiapoi, R.M D. (Line B)	4	..	5
Chetnole Ltd., Glenavy	6	0·2	40
Clarke, V. G., Fairview, Timaru (Line A)	4	..	10
Clarke, V. G., Fairview, Timaru (Line B)	4	..	6
Cooper, C., Arowhenua, Temuka	4	..	1
Cox, N., 238 Wairarapa Road, Christchurch	4	..	2
Crawford, R. T., Yaldhurst (Line B)	4	..	3
Dale, P., Temuka	4	..	1½
Dellow, G., St. Andrews	5	0·2	1
Dunlop, W. N. G., Courtenay, Greendale, R.M.D.	4	1·7	2
Elder, R. P., 109 John's Road, Belfast	4	..	1
Ellis, M. G., Kingsdown, Timaru	5	..	1½
Elworthy, P. A., Gordon's Valley, South Canterbury	4	0·4	3
Evans, C., Southburn, Timaru	4	..	1
Everest, W., care of J. Crozier, Crozier's Road, Christchurch (Line D)	4	0·3	1½
Foster, J. A., Springston, R.M.D. (Line A)	4	..	15
Foster, J. A., Springston, R.M.D. (Line B)	5	..	8
Gardiner, C., care of O. J. Gardiner, Dunsandel, R.M.D.	4	0·7	1
Gillies, O N., Seadown	5	..	1
Gray, J. L., St. Andrews (Line A)	4	..	8
Gray, J. L., St. Andrews (Line B)	5	..	30
Gray, R., St. Andrews (Line B)	5	..	5
Haines, C., 108 Waimak Road, Harewood	4	0·3	2
Ham, A., Grovetown, Blenheim	4	..	4

LIST OF GROWERS—*continued.*

AUCKLANDER SHORT TOP—*continued.*

Commercial Seed (Canterbury and Marlborough)—continued.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
Hampton, G., Kingsdown, Timaru	4	1·0	6
Hampton, G. H., Otipua Road, Timaru	5	..	2
Hardy, A., jun., Winchmore, R.M.D.	4	0·6	1
Harvey, W., Willowby, Ashburton (Line B)	4	..	1
Hartnett, D., St. Andrews	4	..	1
Hartnett, T., Temuka	4	..	3
Hastie, A. W., Pareora, Timaru	4	0·2	2
Hegan, J., and Son, Southbrook	5	0·3	6
Heinisch, A., Springston, R.M.D.	4	0·7	2
Hewson, Mrs. M. S., Orari	5	..	2
Hill, J., Pareora West	5	..	3
Innes, T. S., Sheffield	4	..	2
James, H. W., 137 Fitzgerald Street, St. Albans, Christchurch	4	1·0	2
Jellie, J., Russley Road, Christchurch	4	..	6
Jordan, C. H., Kaiapoi, R.M.D. (Line A)	4	0·2	1½
Jordan, C. H., Kaiapoi, R.M.D. (Line B)	6	..	2
Jowers, G. C., Darfield, R.M.D. (Line B)	5	..	2
Judson, C. J., High Street, Rangiora (Line C)	4	0·3	7
Kelly, D., Willowbridge	5	..	3
King, G. H., West Belt, Rangiora (Line B)	4	0·2	6
King, G. H., West Belt, Rangiora (Line C)	4	..	1
King, J. C., Box 82, Timaru (Line B)	5	..	2
Lister, T., St. Andrews	4	..	1
Marshall, J. G., "Balraizie," Rakaia	4	..	3
Marshall, S. A., Tycho, R.M.D. (Line A)	4	..	2
Martin, F. D., St. Andrews (Line A)	5	..	1
Martin, F. D., St. Andrews (Line B)	5	0·4	1
Martin, W. E., Kaiapoi, R.M.D. (Line A)	4	0·2	4
Martin, W. E., Kaiapoi, R.M.D. (Line B)	6	..	9
Mehrtens, J. L., Camside, Rangiora	4	1·0	3
Miles, H., Fernside, Rangiora	4	0·2	3
Millar, J. E., Killinchy, via Leeston	4	..	3
Moore, H. S., Box 4, Kaiapoi	4	0·2	9
Morrison, J. L., Morven	4	..	5
Mortland, Mrs. S., Templeton (Line B)	4	..	8
Murray, W. J., Spring Creek, Blenheim	4	..	1
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line F)	6	0·3	4
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line G)	4	1·2	2
O'Loughlin, J. (Estate of), St. Andrews	5	..	2
Palmer Bros., Rangitata Island	4	..	1
Palmer, R. R., Orari	4	..	2
Parker, F. A., Spring Creek, Blenheim	5	..	6
Parry Bros., Southburn, R.M.D.	4	..	1
Parry, J. P., Southburn	4	..	1½
Pearce, Miss J. P., Washdyke	4	..	1
Peterson, B., care of T. S. Gillies, Seadown	5	..	3
Pooke, F. J., Pareora	4	..	4
Porter, E., St. Andrews (Line B)	4	..	5
Purvis, G., Oxford Rd., Rangiora (Line A)	4	..	3
Rennie, J., Winchester	5	0·4	1
Richards, L., Kingsdown, Timaru (Line A)	4	..	1½
Roberts Bros., Cannington, Cave	4	..	1
Rollinson, F. A., and Sons, Studholme Junction	4	..	6
Rouse, J. F., St. Andrews (Line B)	4	..	6
Roussell, W. O., Middle Road, Blenheim	4	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Salt, A. J., Fairlie	5	..	2
Schluter Bros., Rangiora (Line C)	5	0·2	7
Scott, A., Kerrytown (Line A)	6	1·0	4
Scott, J., Kerrytown	4	0·3	1
Seyb, L., Washdyke (Line A)	5	..	1
Seyb, L., Washdyke (Line B)	4	..	6
Sharlick, J., Marshlands Road, Ouruhia (Line A)	4	0·3	6
Sharlick, J., Marshlands Road, Ouruhia (Line B)	5	..	4
Shillitto, R. S., 135 Armagh Street, Christchurch	4	..	1½
Sievwright, R M., Washdyke (Line A)	4	..	2
Smith, E. A., Springston, R.M.D	4	1·3	25
Smith, J. and W., Clarkeville, Kaiapoi, R M D	4	0·5	2
Smith, M., Arowhenua, Temuka	4	..	1
Somerville, H J. R., Box 44, Timaru (Line C)	5	..	9
Spillane, A, Temuka (Line A)	4	..	1
Tallott, H, Cust	4	1·2	1
Tiffen Bros., Makikihi	4	..	4
Topham, J. W., Arowhenua, Temuka	6	..	3
Topham, W C, Temuka	5	..	1
Traves, H, Levels	5	0·8	1
Trott and Vincent, Timaru, Waimate, R.M.D	4	..	1½
Weeber, H., Englefield Road, Belfast, N. 2 (Line A)	4	..	8
Weeber, H.. Englefield Road, Belfast, N 2 (Line B)	4	..	4
Wilson, M. G., Springston, R.M.D. (Line A)	4	1·5	1½
Commercial Seed (Otago and Southland)—			
Carroll, J., North Taieri	6	0·5	1
Penman, A. E, Mosgiel	6	1·0	1
Smith, I. J., Bushey, Palmerston	5	..	1
Suburban Finance Co., Cromwell	6	0·6	1
DAKOTA			
Mother Seed (Canterbury)—			
Adams, A, Killinchy, via Leeston	6	..	4
Allen, A., Killinchy, via Leeston	4	..	5
Annand, A. R., care of D. McVinnie, Weedons	5	..	4
Amor, A. W., Woodend (Line A)	6	0·2	1½
Barnett, R., Dunsandel (Line A)	5	..	4
Barr, H. C., Springston, R.M.D.	5	..	8
Bishop, W. J., Southbridge	5	..	2
Breakwell, A. J., Tinwald (Line A)	5	..	7
Brodie, R., Rangitata Island (Line B)	6	..	7
Campion, C. A., Mount Hutt, R.M.D., Rakaia (Line A)	6	..	11
Chappell, T., West Coast Road, Yaldhurst	5	..	3
Chatterton, W. V., Dunsandel (Line B)	5	..	1
Cherry Bros., Eyreton, Kaiapoi, R.M.D. (Line A)	5	..	1
Cross, A. E., Bennetts, via Rangiora (Line A)	5	..	1
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line B)	5	..	4
Eder, W., Sefton, R.M.D.	5	..	3
Frazer, T., Harewood Road, Christchurch	6	..	4
Frizzell, W., Kirwee	6	..	2
Gardiner, O. J., Dunsandel, R.M.D.	6	..	6
Goodwin, W. J., Rangiora	6	..	1
Hardy, A., jun., Winchmore	5	..	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Mother Seed (Canterbury)—continued.			
Harris, V. C., Rangiora	6	..	3
Harrison-Wilke, E. L., Courtenay, R.M.D.	6	..	1½
Johnston, H. W., Box 12, Dunsandel	4	..	10
Johnston, R. H, Dunsandel (Line A)	6	..	2
Lynsky, M., School Road, Yaldhurst	6	..	2
McRobb, A., Mount Hutt, R.M.D., Rakaia (Line B)	5	..	1
McVinnie, D, Christchurch, Greendale, R.M.D.	5	..	2
Mander, H. H., Hawarden	6	..	2
Manson, C. F, Box 2, Coalgate	6	..	2
Marshall, D., Leeston, R.M.D.	5	..	14
Moriarty, L, Southbridge	5	0·2	1½
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line D)	6	..	2
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line E)	6	..	3
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line G)	6	..	3
N.Z. Loan and Mercantile Agency, Ltd, Christchurch (Line H)	5	..	2
Oliver, H. A., Hororata	6	..	1
Oliver, J., Hororata	5	..	1
Orchard, G. B., Cheviot, R.M.D.	5	..	1
Ottley, J., Waimate	5	..	1
Pilkington, R. F., Southbridge	5	..	1
Prosser, Mrs. M. A., Leeston	6	0·3	2
Royds, R S., 412 Burnside Road, Fendalton, N.W. 1 (Line A)	6	..	5
Shellock Bros., Te Pirita, R.M.D., Rakaia	6	..	7
Skerton, G., Hornby	6	..	4
Smith, E. J., Prebbleton	5	..	5
Somerville, H. J. R., Box 44, Timaru (Line A)	6	..	5
Stewart, A., Marsh's Road, Templeton (Line C)	5	..	5
Tweedy, S., Dunsandel, R.M.D.	6	..	20
Walker, C. E. (Estate of), West Melton, Greendale, R.M.D. (Line A)	5	..	1½
Walker, C. E. (Estate of), West Melton, Greendale, R.M.D. (Line B)	6	..	2½
Wolff, R. G., Horrelville, R.M.D.	6	..	8
Wright, Q. A., Annat	4	..	3
Commercial Seed (Canterbury and Marlborough)—			
Alexandre, H., Belfast	8	..	6
Amor, A. W., Woodend (Line C)	8	..	2
Anderson, A., "Crofthead," Southbridge	8	..	14
Ashwell, L., Greendale, R.M.D.	8	..	8
Barnes, C. F., Cheviot, R.M.D.	8	..	2
Beer, G. F., Horrelville, R.M.D.	8	..	4
Bowie, J. H., Otaio	7	..	2
Breading, A. J., Te Pirita, R.M.D., Rakaia	8	..	3
Breakwell, A. J., Tinwald (Line C)	7	..	5
Brodie, R., Rangitata Island (Line A)	7	..	7
Brodie, R., Rangitata Island (Line D)	8	..	1½
Brown G. E., Kaiapoi, R.M.D.	7	..	3
Burns, R. A. C., Te Pirita, R.M.D., Rakaia	7	..	4
Burrowes, J., Chertsey (Line B)	7	..	2
Campion, C. A., Mount Hutt, R.M.D., Rakaia (Line B)	7	..	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Chalmers, G. C., Rangitata	9	..	3
Chatterton, W. V., Dunsandel (Line A)	7	..	5
Cherry Bros., Eyreton, Kaiapoi, R.M.D. (Line B)	7	..	2
Connell, M., Arowhenua, Temuka	7	..	3
Cross, A. E., Bennetts, via Rangiora (Line B)	8	..	1½
Cross, H. E., Sandy Knolls	7	..	1
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line A)	9	..	4
Curtis, J. J., Yaldhurst	8	..	1
Dowdle, T. S., Prebbleton	7	..	1½
Dunlop, W. N. G., Courtenay, Greendale, R.M.D.	9	..	2
Everest, W., care of J. Crozier, Crozier's Road, Christchurch	9	..	1
Fairbairn, J., Springston, R.M.D.	9	..	3
Fine, G. H., 57 Spring's Road, Sockburn (Line A)	8	..	6
Foster, T. C., Springston, R.M.D.	7	..	10
Fowler, G. H., Halkett, R.M.D.	9	..	3
Fowler, J. A., Hillersden, Marlborough	9	..	2
Fraser, J., Woodend	8	..	4
Gardiner, C., care of O. J. Gardiner, Dunsandel, R.M.D.	9	..	2
Giles, N., Seadown, Timaru	9	..	3
Gimson, W., Mitcham, via Rakaia	9	..	4
Harris and Aschen, care of H. Aschen, Ashburton Forks (Line A)	9	..	2
Harris and Aschen, care of H. Aschen, Ashburton Forks (Line B)	9	..	2
Harvey, W., Willowby, Ashburton	9	..	2
Hennessey, W., Mitcham, via Rakaia (Line A)	9	..	1
Hennessey, W., Mitcham, via Rakaia (Line B)	9	..	1
Hooper, R. M., Mitcham, via Rakaia	8	..	4
Johnston, K. A., Selwyn	9	..	2
Johnston, R. H., Dunsandel (Line B)	8	..	1
Jowers, G. C., Darfield, R.M.D. (Line B)	9	..	1
Leslie, W. J., Hornby	8	..	2
McCartin, J., Leeston, R.M.D. (Line A)	9	..	12
McDermott, E. C., 25 Tankerville Street, Christchurch, S.W. 2	7	..	7
Moore, H. S., Box 4, Kaiapoi (Line A)	8	..	3
Moorhead Bros., Southbridge, R.M.D. (Line A)	8	..	11
Moorhead Bros., Southbridge, R.M.D. (Line B)	9	..	10
Moorhead Bros., Southbridge, R.M.D. (Line C)	9	..	25
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line F)	8	..	2
Oakley, L. O., Rakaia	9	..	1
Orbell, W. H., Levels	7	..	1
Palmer Bros., Rangitata Island	8	..	2
Palmer, R. R., Orari	8	..	2
Payne, J., Yaldhurst, Greendale, R.M.D. (Line A)	9	..	15
Peach, J., Sefton, R.M.D.	9	..	1
Phillips, A., Weedons, Springston, R.M.D.	9	..	8
Phillips, A. G., Weedons, Springston, R.M.D. (Line C)	8	..	2
Prebble, R. W., Halkett, R.M.D.	8	..	1½
Robinson, R. G., Ltd., Box 4, Papanui	7	..	1
Robson, F. H., Box 22, Lincoln	8	..	5
Royds, R. S., 412 Burnside Road, Fendalton, N.W. 1 (Line B)	8	0·1	3

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Ryan, P. F., Springs, Weedons, R.M.D.	9	..	20
Shellock, W., Te Pirita, R.M.D., Rakaia	7	..	5
Somerville, H. J. R., Box 44, Timaru (Line B)	8	..	4
Stevenson, T. J., Rakaia	7	..	1
Swanson, W., Selwyn	8	..	½
Tallott, E. D., Cust	8	..	1½
Thomas, C. B., Springston, R.M.D.	8	..	8
Upston, E. E., Selwyn	8	..	12
Watson, M. E. M., Dunsandel	8	..	7
Ward, R. R., Hook	7	..	2
Wilkinson, V., Mitcham, via Rakaia	8	..	5
Williams, J. W., Whincops Road, Halswell	8	..	3
Wilson Bros., Halkett, R.M.D	9	..	3
Wilson, M., Halkett, R.M D.	8	..	6
ARRAN CHIEF.			
Mother Seed (Canterbury)—			
Barnes, R., John's Road Belfast	4	0·7	1½
Barnes, W., and Son, 199 Highsted Road, Styx	4	0·4	5
Blair, C., Willowbridge	3	..	2
Boyce, W. J., Waituna, Waimate	3	..	2
Campbell, P., Studholme Junction (Line A)	4	..	3
Cox, S., Willowbridge	3	..	4
Faulkner, J. C., Willowbridge (Line B)	3	..	2
Fletcher, W. J., "Hopefields," Willowbridge	4	..	8
Foley, T. F., Waituna, Waimate	3	..	1
Forsyth, J., Willowbridge (Line A)	3	0·5	2
Forsyth, J., Willowbridge (Line C)	4	..	1½
Hayman, A. B., Studholme Junction	3	..	3
Hayman, T. L. and A. F., Studholme Junction (Line B)	4	..	2
Henshaw, F. J., Studholme Junction (Line B)	3	..	5
Hewson, R. H., Seadown P.O.	3	..	2
Kelly, D., Willowbridge (Line A)	4	0·5	3
Lindsay, J., Studholme Junction (Line A)	4	0·5	3
Lindsay, J., Studholme Junction (Line B)	3	..	2
Meynell, T. W., Waimate	4	..	2
Moore, H. S., Box 4, Kaiapoi (Line A)	4	0·2	6
Moore, H. S., Box 4, Kaiapoi (Line B)	4	0·1	4
Paul, A., Waimate (Line A)	3	..	1½
Rollinson, F. A., and Sons, Studholme Junction (Line B)	3	..	6
Wilson, E. R., Waimate (Line A)	3	..	2
Wright, L. T., Annat	3	0·7	8
Mother Seed (Otago and Southland)—			
Anderson, A., Stirling (Line B)	4	..	1½
Birse, J. W., Te Wae Wae	3	..	2
Bruce, J. A., Otahuti, R.M.D, Invercargill	3	..	3
Corkery, J., Te Wae Wae	2	..	1
Daly, P. G., Te Wae Wae	3	..	3
Dobbie, R., Menzies Ferry	4	0·2	2
Griffin, G., Te Wae Wae	4	..	2
Griffin, J. G., Te Wae Wae	2	..	4
Hamilton, G., Tuatapere, R.M.D.	2	0·2	3
Knowler, H., sen., Te Wae Wae	2	1·0	5
Lobb, J. H., Tuatapere	4	..	1
Sim, A. R., Pikopiko, Tuatapere	2	..	1
Skinner, J. L., North Taieri (Line A)	3	0·2	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No	Percentage of Foreign Varieties	Area in Acres.
DAKOTA—*continued*			
Commercial Seed (Canterbury)—			
Barclay, G. M. M., Riverlands, Waimate	6	..	16
Batchelor, R. S., Waimate	6	1·5	2
Hayman, T. L., and A. F., Studholme Junction (Line A)	5	0·2	6
Henshaw, F. J., Studholme Junction (Line A)	6	1·0	6
Judson, C. J., High Street, Rangiora	6	0·2	7
Kelly, D., Willowbridge (Line B)	5	0·6	16
Kelly, D., Willowbridge (Line D)	6	0·3	7
Kelly, D., Willowbridge (Line E)	7	1·7	30
McDonald, M., Allan Street, Waimate	5	1·2	2
Meredith, R. J., Waimate	6	..	1
Meyer Bros., Waimate	7	0·2	2
Morris, M. J., Willowbridge (Line A)	5	0·7	3
Murphy, M., Morven	7	0·6	5
Paul, A., Waimate (Line B)	6	..	5
Rollinson, F. A., and Sons, Studholme Junction (Line A)	6	..	10
Saunders, E. E., Studholme Junction (Line A)	7	..	7
Saunders, E. E., Studholme Junction (Line B)	6	..	3
Wilson, E. R., Waimate (Line B)	5	..	9
Commercial Seed (Otago and Southland)—			
Anderson, A., Stirling (Line A)	6	..	3
Beckingsale, J. H., Herbert	7	..	1
Bell, J. F., Stirling	6	0·2	4
Forde Bros., Te Tua	5	1·8	2
Harvey, W., Mosgiel (Line A)	6	..	2
Harvey, W., Mosgiel (Line B)	6	1·2	2
Hurst, S. M., Papakaio	7	0·7	1
Jensen, A. A., Stirling	5	..	1
Knowler, C. E., Box 97, Tuatapere	5	0·2	4
Knowler, H. C., jun., Te Wae Wae	5	0·8	4
Orbell, A., Waikouaiti	6	..	1½
Skinner, J. L., North Taieri (Line B)	5	1·9	1
Smith, I. J., Bushey, Palmerston	6	0·2	2
KING EDWARD.			
Mother Seed (Canterbury)—			
Bisdee, J. C., Clandeboye, Temuka	4	..	1½
Guthrie, A., Orari	4	..	1½
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	3	0·2	2
Mother Seed (Otago and Southland)—			
Arthur, W., Box 16, Tuatapere	4	0·8	2
Bennett, J. J., Tuatapere, R.M.D.	2	..	1
Bennett, J., jun., Tuatapere, R.M.D.	2	0·4	8
Birse, J. W., Te Wae Wae	2	..	1
Blakie, L., Section 1, Otahuti, R.M.D., Invercargill	4	..	1
Bruce, J. A., Section 2, Otahuti, R.M.D., Invercargill	3	..	1½
Burgess, D., West Plains, R.M.D., Invercargill	3	..	1
Clark Bros., Ryal Bush	4	..	1
Corkery, J., Te Wae Wae	2	..	1
Forde Bros., Te Tua	3	0·2	2
Free, A. T., Outram	4	..	5

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
KING EDWARD—*continued.*			
Mother Seed (Otago and Southland)—continued.			
Griffin, G., Te Wae Wae	2	..	3
Griffin, J. G., Te Wae Wae	3	..	2
Hamilton, G., Tuatapere, R.M.D.	4	..	3
Imrie, J. M., Mosgiel (Line A)	4	..	2
Jenkins, G. R., Tuatapere	3	..	2
Knowler, H. C., jun., Te Wae Wae	4	..	1
Ledington, F., Lochiel	3	..	1
Lobb, J. H., Tuatapere	3	..	1
Milburn, M., Wright's Bush, R.M.D., Invercargill	2	..	2
Myron, A., Ryal Bush	3	..	2
Norman, H. D., Tuatapere	4	0·2	4
Paulin, T. G., Outram	4	..	1½
Read, J. G., Mosgiel	4	..	1
Ryan, P., and Son, Gorge Road, Southland	4	..	1½
Sheddan, G. B., Section 2, Otahuti, R.M.D., Invercargill	3	..	1
Skinner, J. L., North Taieri	3	..	1½
Stiven, J. E., Paretai, R.M.D. Balclutha	3	..	1
Taylor, W. G., Mosgiel	4	..	1
Throp, O. R., Te Houka, Balclutha	4	..	2
Wilson, C. H., Lorneville, Invercargill	3	..	1½
Commercial Seed (Canterbury)—			
Bird, A. M., Waimate	5	..	2
Commercial Seed (Otago and Southland)—			
Anderson, A., Stirling	6	..	3
Graham, J. W., Mosgiel (Line A)	5	..	4
Gray, J. S., Frankton	5	..	1
Kirk, R., Tapanui	5	..	1
Smith, G. C., Deborah, R.M.D.	6	..	1
Thornton, A. F., Momona	5	..	2
Thornton, F. J., Momona	5	..	4
Thornton, J. W., Momona	5	..	5
Waite, A., Tapanui	5	..	1
Weir, J. G., Stirling	5	..	3
INVERNESS FAVOURITE.			
Mother Seed (Canterbury)—			
Adams, A. A., Annat	3	..	1
Atkinson, R. J., Annat	2	..	3
Barclay, G. M. M., Riverlands, Waimate	2	..	2
Breakwell, A. J., Tinwald	2	..	2
Hanna, M., Sefton	3	..	4
Harris, V. C., Rangiora (Line A)	3	..	4
Hurley, H., jun., Balcairn	2	..	4
Kelcher, F. M., Balcairn	3	..	2
Lewis, E. D., Sefton, R.M.D.	1	..	4
Lowe, G. J., Coldstream, Rangiora	2	..	2
Macdonald, R., Annat	1	..	10
Mehrtens, J. L., Camside, Rangiora	2	..	3
Payne, A. E., Springston, R.M.D.	3	..	2
Peach, J., Sefton	3	..	1
Petrie, J., jun., Swannanoa	2	..	1½
Piner, E., Annat, R.M.D.	1	..	2
Commercial Seed (Canterbury)—			
Chetnole Ltd., Glenavy	4	0·1	15
Rose, C. F., Hook, R.M.D.	4	..	7
Somerville, H. J. R., Box 44, Timaru	4	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
INVERNESS FAVOURITE—*continued.*			
Commercial Seed (Otago and Southland)—			
Graham, J. W., Mosgiel	4	..	1
Smith, I. J., Bushey, Palmerston	4	..	1
AUCKLANDER TALL TOP.			
Mother Seed (Canterbury)—			
Bailey, J., Kaiapoi, R.M D.	3	..	8
Bonnett, N. M., Rangiora	3	..	3
Frost, C. H., Balcairn	3	..	2
Guy, T. A., and E. B., Courtenay, R.M.D.	1	..	6
Hardy, A., jun., Winchmore, R.M D.	3	..	1
Hardy, G., Winchmore, R.M.D.	3	..	2
Harrison-Wilke, E. L., Courtenay, R.M.D.	2	..	1
Judson, C. J., High Street, Rangiora	3	..	15
Minchington, F. W., Fernside	3	..	3
N.Z. Loan and Mercantile Agency, Ltd., Christchurch	2	..	1½
Oliver, J , Hororata	1	..	4
Roper, R S., Halkett, R.M.D	3	0·8	3
Steele and Dawson, care of F. Steele, Fernside (Line A)	1	..	10
Steele and Dawson, care of F. Steele, Fernside (Line B)	3	..	3
Commercial Seed (Canterbury)—			
Breakwell, A. J., Tinwald	4	0·2	3
Ellis, M. G., Kingsdown, Timaru	4	..	1½
Fell, E T , Otipua, R M D	5	..	4
Rangiora High School, Rangiora	4	..	5
Seyb, L., Washdyke	5	..	4
Simmons, W , Kingsdown, Timaru	4	..	1½
ARRAN BANNER			
Mother Seed (Canterbury)—			
Leathwick, A., Hunter, R.M.D	4	..	2
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2	3	0·5	4
Simmons, W., Kingsdown, Timaru	4	..	2
White, R. Y., 402 North Road, Styx	3	..	2
Mother Seed (Southland)—			
Knowler, H., sen., Te Wae Wae	4	0·2	1
Commercial Seed (Canterbury)—			
Amyes, H. C., "Riversleigh," Annat, R.M.D.	5	..	5
Robinson, R. G., Ltd., Box 4, Papanui (Line A)	6	..	3
Robinson, R. G., Ltd., Box 4, Papanui (Line B)	5	..	4
Steele and Dawson, care of F. Steele, Fernside	5	..	2
Commercial Seed (Otago)—			
Smith, G. C., Deborah, R.M.D.	6	..	1
EPICURE.			
Mother Seed (Canterbury)—			
Hobday, J. H., 33 John Street, Papanui	4	0·2	3
Macdonald, R., Annat	4	..	5
Marshall, D., Killinchy, Leeston, R.M.D.	5	..	5
Shellock Bros., Te Pirita, R.M.D., Rakaia (Line A)	4	..	1
Wright, L. T., Annat	4	..	2
Wright, G. A., Annat	4	..	1

LIST OF GROWERS—*continued*.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
EPICURE—*continued*.			
Mother Seed (Southland)—			
Burgess, D., West Plains, R.M.D., Invercargill ..	5	..	1
Commercial Seed (Canterbury)—			
Spillane, A., Temuka	6	..	1
Commercial Seed (Otago and Southland)—			
Kirk, R., Tapanui	6	..	1
Middlemiss and Burnby, East Chatton ..	6	..	1
AMERICAN WONDER.			
Mother Seed (Canterbury)—			
Cox, N., 238 Wairarapa Road, Christchurch ..	4	..	1
Franks, W. T., 103 Gray's Road, Upper Fendalton	5	..	2
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2	5	..	2
Commercial Seed (Canterbury)—			
McPhail, W. A., Mitcham, via Rakaia ..	7	..	1
Shellock, W., Te Pirita, R.M.D., Rakaia ..	7	..	1
IRON DUKE.			
Commercial Seed (Canterbury)—			
Croft, R., "Glenlea," Amberley (Line A) ..	7	..	1½
Croft, R., "Glenlea," Amberley (Line B) ..	8	..	4
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	6	..	4
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line C)	7	0·2	2
Commercial Seed (Otago)—			
Grant, G. B., Puerua, Otago	6	..	3
JERSEY BENNES.			
Mother Seed (Canterbury)—			
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2	5	..	2
Mother Seed (Southland)—			
Burgess, D., West Plains, R.M.D., Invercargill ..	5	..	3
Commercial Seed (Canterbury)—			
Annand and Co., A. B., Timaru	6	..	1
Commercial Seed (Otago)—			
Graham, J. W., Mosgiel	7	..	1½
McGregor, A., Factory Road, Mosgiel	7	..	2
EARLY REGENT BOLTER.			
Commercial Seed (Canterbury)—			
Caldwell, G. D., 165 Russley Road, Upper Fendalton	6	..	1
Oakley, W., Hororata	6	..	5
Wilson, M., Halkett, R.M.D.	7	..	2
EARLY ROSE.			
Mother Seed (Canterbury)—			
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	3	..	2
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line B)	4	..	2
Shellock Bros., Te Pirita, R.M.D., Rakaia ..	3	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
MAJESTIC.			
Mother Seed (Canterbury)—			
Crozier, W. J., Mount Hutt, R.M.D., Rakaia ..	6	..	6
Hobday, J. H., 33 John Street, Papanui ..	5	..	3
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line B)	4	..	3
UP TO DATE.			
Commercial Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	6	..	1
Somerville, H. J. R., Box 44, Timaru	6	..	3
Commercial Seed (Otago)—			
Sanders, W. M , Rockford, Clinton	6	..	2
ARRAN CONSUL.			
Mother Seed (Canterbury)—			
Macdonald, R., Annat	3	0·5	5
Robinson, R. G , Ltd., Box 4, Papanui ..	4	0·2	2
CLIFFS KIDNEY.			
Mother Seed (Canterbury)—			
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	5	0·3	4
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line B)	4	..	1½
GREAT SCOT.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	4	0·2	2
Commercial Seed (Canterbury)—			
Wright, L. T., Annat	5	1·3	2
MAORI CHIEF.			
Mother Seed (Canterbury)—			
Robinson, R. G , Ltd., Box 4, Papanui ..	3	..	4
ROBIN ADAIR.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui (Line C)	5	..	1
SIR J G. WILSON.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	3	..	2

—*Fields Division*

Field trials and farming experience have again emphasized the enormous value to New Zealand of "strain" in grasses and clovers as a factor to progress. Reports from the South Island from even the most arable districts are extremely encouraging, particularly from the point of view of the rye-grass strain used. New Zealand certified strains are being increasingly demanded. Plot-trial, field-trial, and farm-scale experience is also emphasizing the value of the New Zealand No. 1 white-clover type, and this fairly bids to rival certified perennial rye-grass in importance viewed from the point of view of strain.—*Report, Agrostologist.*

SEASONAL NOTES.

THE FARM.

The Problem of Inferior Composition of Pastures.

THERE is evidence in the main grass-farming districts of a tendency on the part of both dairy-farmers and sheep-farmers to continue using swards composed of inferior plants when it would be relatively easy and distinctly profitable to replace them with swards consisting largely of more productive pasture-plants. This is particularly true of the many farms on which it is customary to experience shortage of feed at one or both of the critical seasons of low direct production of pastures—*i.e.*, the late-winter and early-spring period and the late-summer period.

There are three basic facts in this matter. In the first place there are inferior pastures of which economic improvement is or at least is considered to be impossible in the light of our present knowledge. Secondly, such pastures are not at all as numerous as many seem to believe, and additions to our experience are periodically making them less numerous ; for instance, the use of subterranean clover makes it possible to improve remarkably certain poor pastures, whereas payable means of improving these pastures without using subterranean clover are not known. Thirdly, after making full allowance for the dwindling number of pastures which we do not know how to improve economically we have thousands of pastures which can be improved profitably by one or more of the following practices : top-dressing, surface-sowing of seed, and resowing on a cultivated seed-bed.

While poor pastures can often be improved substantially by suitable top-dressing, it should be borne in mind not only that the repairing of pastures by top-dressing alone is usually a relatively slow process, but also that the amount of improvement possible under normal management depends to a large extent upon the plants which are present at the outset, and, because of this, at times it is not as great as is desirable.

In certain circumstances which are not at all uncommon the surface-sowing of suitable seed in combination with appropriate top-dressing gives much greater and quicker improvement than could be obtained by top-dressing alone. Surface-sowing of two distinct types has on occasions been carried out successfully on poor pastures. Firstly, there has been the use of a mixture designed to give a good mixed permanent pasture ; of this the total experience is not extensive, and, further, failures from such surface-sowing must be viewed as a possibility. Secondly, especially in recent years, surface-sowing has often been confined exclusively to the use of subterranean clover, and this in quite a satisfactory percentage of cases has been attended with distinct success when the pastures have been so open at the time of surface-sowing that the seedlings of subterranean have been able to establish themselves without the competition for a foothold in the soil and for a supply of sunlight which they have to face in dense swards, say, of brown-top, for instance, on which surface-sowing has been far from uniformly successful.

By the foregoing statements it is intended to indicate that top-dressing, or top-dressing in combination with surface-sowing, at best is a somewhat uncertain or imperfect means of improving poor pastures. Hence, frequently the case for the renewal instead of the repairing of poor pastures is a strong one. The repairing process, however, may be the best course when the farmer is handicapped in regard to finance or labour or when all the equipment to be used in the work of repairing would have to be purchased. Again, the repair of pastures may be the only possible course, as, for instance, when the land is rough or timbered or when the soil is so light and subject to wind that the danger of erosion forbids cultivation.

The improvement of pastures by resowing after an arable period not only can be carried out quickly, but also makes it possible to take advantage of recent advances in regard to strain differences within pasture species. Hence the improvement often may be made a double-feature one—the sowing of more valuable species such as rye-grass, cocksfoot, and clovers in place of brown-top, rib-grass, catsear, &c., can be linked with the use of the better strains that were not readily procurable when the pasture, if an old one, was previously sown down. The official system of seed certification has resulted in a dependable supply of such strains. When improvement of a pasture by renewal is being considered, it should be kept in mind that while lack of fertility is not always the cause of inferior pastures it frequently is so. If a pasture is inferior because of the lack of fertility under which it exists, then it is of prime practical importance to bear in mind that the mere sowing of seed fitted to give a good pasture will not necessarily give such a pasture; if improved fertility by means of such practices as top-dressing and drainage is needed, then, until the fertility is suitably improved, the sowing of good seed will prove futile to a considerable extent. In practice this seems sometimes to be completely overlooked. For instance, a pasture which is of low production and poor composition is broken up and arable crops which impoverish the land are grown before the area is again sown in grass. Really in such circumstances it is unreasonable to expect an improved permanent pasture until the fertility is made greater than it was prior to the impoverishment by the exhausting crops. It follows that in the circumstances cited any cropping prior to the sowing of the permanent pasture should be fitted to increase instead of to exhaust the fertility of the soil. This common-sense course is reversed in those numerous cases in which such crops as oats, maize, and millet precede permanent pasture in land the fertility of which prior to these crops tends to be inadequate for the type of pasture it is desired to obtain; the crops named and similar ones in general reduce fertility, especially when they are not consumed where they are grown. If land is worn out to some extent by cropping prior to the sowing of permanent pasture, then a liberal fertilizing of the young pasture in its early stages becomes particularly advisable.

July Top-dressing.

Extensive field experience has taught that top-dressing, if not already done, may be carried out with good results in July. In many of the main dairying districts, even in the case of wet relatively cold soils, superphosphate applied in July may be expected to bring about useful increases in the amount of feed available directly from the pastures in August. When speedy benefit from top-dressing is desired, as it usually is, then superphosphate ordinarily should be used, and in districts in which liming is profitable lime should be applied shortly before or at the same time as the superphosphate if benefit from a previous liming is not still being obtained.

On many occasions in these notes the application to grassland of superphosphate and of other phosphates much earlier in the year has been recommended. That recommendation continues, but many who have not top-dressed or not top-dressed enough prior to winter would be wiser to do it in July or thereabouts than to do no further top-dressing during this year.

If the weather conditions do not lead to an unusually late commencement of increased growth-rate of grass in the new season, then the application of sulphate of ammonia or similar nitrogenous fertilizer about mid-July to suitable pastures may be expected to result in a substantial increase in the feed available from treated fields in August and September, but for a few weeks prior to mid-July it is usually inadvisable to apply such nitrogenous fertilizer. As a general rule superphosphate should be used in conjunction with sulphate of ammonia. Whether sulphate of ammonia or similar nitrogenous manures should be used in the manner just specified is determined to a considerable extent by how acutely additional early feed is needed. A further question likely to arise is whether the necessary additional feed could be obtained more cheaply than by the use of a quickly acting nitrogenous fertilizer.

Harrowing and Spelling of Pastures.

Harrowing of pastures usually calls for widespread attention in July, when it is particularly advisable to break up and distribute thoroughly droppings on fields which have been heavily stocked during May and June. To bring about thorough distribution a section of chain-harrow attached behind the grass-harrow generally proves of value.

As a means of avoiding early setbacks it is very desirable to have attractive suitable feed available for early-calving cows and for early-lambing ewes. To provide such feed it often is very advisable to shut up in July suitable pastures, preferably ones which are well drained and sheltered and in which rye-grass is prominent. An immediate top-dressing of such pastures with superphosphate, if they have not been top-dressed prior to winter, is likely to be of assistance.

Trampling of wet soft paddocks leads not only to direct loss of valuable plants by burial, but also to the possibility of the establishment of such weeds as thistles, docks, rushes, buttercups, and daisies on the bare surface soil which results from the burial of valuable components of the pasture. Among the main ways of reducing the damage from trampling to a minimum are—(1) The stocking of wet areas as little as possible; (2) the feeding-out of hay, &c., on the drier portions of the farm, which often are the poorer portions that benefit most greatly from the increased fertility that feeding-out gives; (3) the feeding-out of hay, &c., on the poorer pastures which are soon to be put to arable use.

Arable Cropping.

As a rule, the sowing of seed in July in inadvisable. Hence if wheat cannot be sown by about mid-June the sowing usually may with advantage be deferred until August, unless the doing of this seems likely to lead to a subsequent embarrassing rush of work.

Every opportunity should be taken to go ahead with cultivation in preparation for the spring sowing of cereals, mainly in the August-September period, but the harm to the tilth of the soil which results from the tillage of heavy wet soils should be avoided.

As a means to more profitable feeding of stock, two crops which, having regard to their merits, are much neglected are lucerne and mangels. The 1935–36 Dominion acreage of mangels was considerably above the average acreage for the ten years ending at the 1935–36 season; definite figures are not yet available relative to the 1936–37 acreage, but reports from seed-merchants suggest an appreciable decline. A decline is directly contrary to the needs of the position unless other feed to replace that yielded by the mangel is being provided, but of this there is no evidence. It has been stated that recent changes in the farm-labour position are adversely affecting the area devoted to arable crops generally, but especially that devoted to the mangel. In this connection it should be remembered that the well-managed highly productive mangel crop can remain distinctly profitable when loaded with labour charges great enough to make many other crops unprofitable. Mangel crops of 60 tons an acre or more are so common that it is clear that when conditions are suitable for mangels a 60-ton-an-acre crop is not an exceptional achievement. When hay is worth £3 a ton, then mangels are worth at least 10s. a ton, so that the value of a 60-ton crop is £30 an acre—a value which after allowing for other charges leaves a substantial sum for labour costs.

The outstanding value of lucerne has been demonstrated convincingly by farm results in many districts. New Zealand experience confirms that of other countries in that it shows what a definite misconception it is to believe that lucerne is particularly exacting in its requirements: it has been found in New Zealand that lucerne succeeds on practically all types of naturally well-drained soil, and that there is a profitable role for lucerne at least whenever a dry summer spell causing a shortage of green non-stemmy feed from pastures is expected fairly frequently.

Lucerne may with advantage follow old pasture, and if it does so, then the land should be skim-ploughed well ahead of the time of seeding, and subsequently ploughed deeply once only. Detailed guidance regarding lucerne-culture is contained in this Department's Bulletin 155, available for free distribution.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Planting.

THE planting of trees may be carried out where the land is in a suitable condition and well drained. If the land is not in suitable condition planting should be delayed until the spring, when the ground has become reasonably dry and warm. This is in order that the trees may quickly establish their roots in their new position in which they are placed in the orchard.

The correct depth of planting is very important. Trees require to be planted at a depth of 2 in. to 3 in. greater than they were in the nursery. If they are planted too deeply they will not do well, and if they are too shallow they are liable to be blown over, and to suffer root injury when the land is being worked.

Cultivation.

Ploughing may be carried out where the land is in a suitable condition, and should be completed as early as possible. A depth ranging from 3 in. to 8 in., according to the age of the trees and the depth of the roots, is usually sufficient to turn in and cover the weeds and other volunteer growth and cover-crop. Close up to the trees the depth of the ploughing should not be greater than 3 in. to 4 in.

Maintenance of Plant.

During the winter months advantage should be taken of wet days to clean, oil, and repair or paint implements, tools, harness, &c. The spray-pump should be the first to receive attention, and the whole outfit should be thoroughly overhauled and put in good working-order. In localities subject to heavy frosts no liquid should be left in the pump, otherwise it may be seriously damaged, with the result that spring spraying will be delayed and may have to be omitted altogether, to the detriment of the trees and subsequent crops. Hares and rabbits cause considerable damage to young trees in many localities at this time of the year: in a single night large numbers of trees have been ruined by these pests. In localities where they are present the orchard should be netted. All netting fences should be examined carefully, and any holes which may be found should be repaired at once. Clear all hares or rabbits from the orchard. Where netting is not provided the trunks and lower branches of the trees should be painted with "Stockholm" tar, which has proved an effective deterrent of the attacks of these pests, and this without injury to the bark. It is not advisable to paint it on the buds. "Stockholm" tar is not liable to cause injury to the trees, but there is a probability of damage if trees are painted with coal tar.

Fruit in Storage.

Fruit in cool and ordinary storage should now be examined at frequent intervals. Much loss has been suffered by orchardists because of neglect in this direction. Apples should be disposed of while sound and in good condition, and before they show any signs of wilting or before they become over-ripe. Over-mature fruit will not stand the handling that freshly picked fruit will do, and such fruit frequently arrives on the market in an unsaleable condition. Pears should be disposed of before they become too yellow and ripe. All stored fruit should be repacked before it is placed on the market.

Pruning of Apples.

When planting a young apple-tree, of no matter what variety, always remove the centre-leader. Choose well-grown yearling or two-year old trees from a reliable nurseryman and see that they are free from all disease. The main stem should be short and not more than 18 in. high. Select three well-placed arms starting from different portions of the main stem at a wide angle if possible, and remove all others. Shorten the three arms back to three or four buds, pruning to side buds which will throw the shoots in the required direction, the object being to form a wide stout base of main arms upon which to build the future tree; these main arms jointing at different parts round the trunk give a very strong base. In the second year's pruning the trees are again pruned, about 9 in. to 1 ft. being left, and a well-placed fork being obtained by pruning to suitable side buds will give six leaders. Remove all but a few laterals from the inside of the tree, also thin out any excess of laterals on the outside of the limbs, and slightly shorten back those left.

In the third winter's pruning, prune fairly hard, leaving up to 18 in. on each leader, and cutting to a well-placed side bud on each, which will now give twelve leaders.

After the third year we have to consider future crops of fruit and vary the pruning practice so as to throw the tree into bearing. This must be done gradually, as the young tree must not be exhausted by being made to bear heavy crops, but should be gradually brought into full bearing as it approaches and reaches the age of eight or ten years, according to variety. The object is to maintain a strong, healthy, and vigorous low-set tree, capable of bearing regular and heavy crops of fruit from base upwards on the framework or leaders established, without any breaking-down of the limbs or stunting of the tree, this framework being so well spaced as to allow plenty of room between each leader, and the centre of the tree being kept as well open as the variety and climatic condition require, all the main and secondary arms being at an angle and not upright to the trunk. The fruiting wood or spurs should be built up gradually each year on all varieties of trees.

Sturmer and other varieties that spur freely are usually heavy croppers, but some of the laterals should be left long-pruned to make fresh fruiting-wood to take the place of the worn-out fruiting-spurs. The spurs so increase and multiply as the tree ages that it is necessary to thin them heavily, otherwise they rob each other, the flowers become weak and sterile, and the tree does not set its crop well In addition to thinning out fruit-spurs and shortening some of the laterals, it is necessary to prune the leader-growth back to from 6 in. to 9 in. to enable the tree to make good sturdy lateral growth, otherwise it may become stunted.

Jonathan, Cox's Orange, and other varieties that fruit mainly on laterals and do not readily produce fruit-spurs require more skill in pruning than do the free spur-bearing varieties. It is very often necessary to prune these varieties to inside buds on the leader growth or to an upright lateral to prevent the trees from spreading too much. The laterals (and leaders) should be shortened only to good stout buds, as the two first are often blind. The leaders require to be kept well spaced and should not be allowed to overcrowd each other. As soon as the required number of leaders—*i.e.*, eight to twelve—have been obtained, they are not again forked or branched in pruning but are kept intact right through, the extremities being kept clean of all lateral growths so as to ensure a strong vigorous growth. This process is continued each year, and the laterals kept healthy, strong, and productive by shortening in after they form fruit-buds. Any laterals that have been left unpruned must be shortened in the following year, more especially the longer ones, not only because the trees will overbear, but each lateral will soon become barren near its base instead of increasing and multiplying.

Rome Beauty and Irish Peach varieties are somewhat difficult to bring into bearing and keep healthy and vigorous. In their young stages they are very vigorous, but if not treated correctly are inclined to stunt and show too much bare wood.

The short laterals should not be touched, but the longer ones should be both winter and summer pruned. By judicious summer pruning or pinching of the laterals they may be made to spur readily.

The best results of summer pruning are obtained by shortening the long lateral growths back to five or seven buds during the months of February or March. If cut back too early they are inclined to break into growth instead of forming fruit-buds. If summer pruning is continued for several years, both of these varieties will eventually become more or less spur-bearers, instead of carrying their fruit only at the extremities of the laterals.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus Culture.

Picking is the chief work in the grove during the next few months. The matter of the careful handling of citrus fruits in all stages from the tree, through the curing and packing rooms, and on to the consumer, is one which leaves so much room for improvement that no apology is offered for again bringing it prominently under notice. The subject was dealt with in the notes appearing in the issues of the *Journal* for May and February last, and the reader is urged to look over these and apply the suggestions therein to his grove whenever consistent with the work in hand.

During harvesting it often happens that failure to control disease in the earlier part of the season is brought very forcibly under the notice of the grower in the shape of a large percentage of diseased or blemished fruit. The former, of course, must not be sold, while the latter may be marketed only under one or other of the lower-grade marks such as " Good " or " X " grade. It may be said with some truth that the percentage of " reject " fruit produced is an indication of the efficiency of the management of an orchard. An analysis of the cause of the blemish on the low-grade fruit will show that while some types of injury are difficult to avoid, others can be eliminated by spraying, a good instance of the latter being thrips injury.

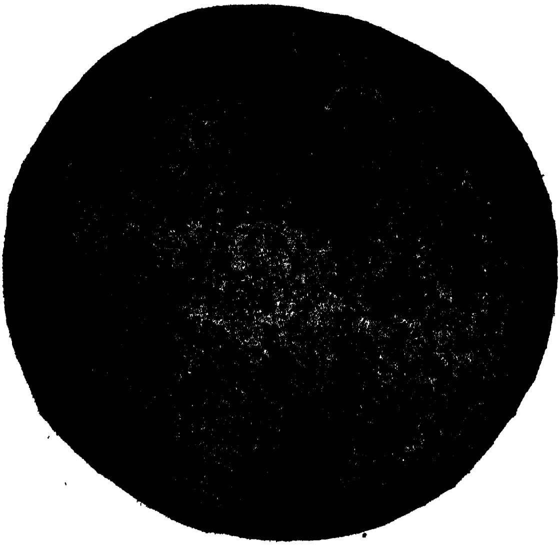

FIG. 1. SEVERE INJURY TO SKIN OF ORANGE DUE TO THRIPS.

It is evident that the control of thrips has often been neglected in the past, but now that the grade standards are to be strictly enforced and competition is becoming more keen growers will have to make determined efforts to deal with this insect, the control of which was outlined in the October and December notes.

Packing: The regulations for the standardization of grades of fruit sold on the local markets stipulate that the fruit be properly packed, so that growers who do their own packing should see to it that their work is of the required standard. The pocket pack should be used, and, while practically every one is familiar with this pack, the actual execution of the work is often at fault. One of the most frequent complaints by the buyers is on account of slack packs, which, on arrival at the markets after the handling during transit, give the boxes the appearance of being only partly filled. Packers must take care to see that each subsequent layer of fruit is placed well down into the pocket provided in the layer previously put in. This is important, and is the whole secret of the elimination of slack packs. Another fault which occurs very frequently is the failure to build up a crown pack right from the time of placing in the second layer, with the result that when the pack is finished the fruit is at an even height above the top of the case from end to end. This means that in the process of lidding the fruit at the ends has to be literally squashed into position, with the resultant bruising of quite a number of fruits. If the crown pack is built up from the beginning, the end fruits are only slightly above the boards at the finish while those in the centre are about 1 in. up, the surface from end to end being evenly curved. The bulge required for local market fruit, although distinct, is as a rule below that applied for export fruit.

The method of building up a crown pack is by means of a difference in the depth of the pockets in the first layer, and not, as has often been supposed, by the selection of smaller-diameter fruit for the end positions. When about three-quarters of the first layer has been placed in position the packer should put both hands in the box and draw the fruit slightly towards the packed end. This operation has the effect of tightening up the pockets towards the centre but still leaves those towards the end of a larger size. The remaining few fruits are then put in with wide pockets, and when the second layer has been placed in position the bulge has already commenced. To avoid loose packing, each subsequent layer must go properly down into the pockets available, but the pockets in the middle of the layer, being smaller, do not allow the fruit to go so deeply, thus building the bulge.

To obtain a good pack the fruit should be of uniform size, and while the regulations allow a slight variation to the extent of ¼ in. *above* the size branded on the case, it should be noted that no fruit *below* that size may be included. —*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

Duck-keeping.

It is generally agreed that most of our domestic ducks have descended from the wild or Mallard duck. The most popular breeds in this country at the present time are the Indian Runner, Khaki Campbell, and Pekin. Results from our local egg-laying competitions indicate that good strains of Indian Runners and Khaki Campbells are probably the greatest egg-producers of all species of bird life.

History tells us that Indian Runners were first introduced into England from India about 1840, and owing to their great egg-producing qualities they soon established a local reputation and gradually spread to other countries. The "New Zealand Utility Poultry Standard" sets down the standard weight of Indian Runners as follows: Drakes over twelve months, 5 lb. to 6½ lb.; ducks over twelve months, 4 lb. to 5½ lb. The chief characteristics of the Runners are their peculiar erect penguin-like carriage and active habits. They were termed " Indian Runners " on account of their peculiar running gait so distinctive from the " waddle " of other breeds.

The Khaki Campbell is a much more recent creation, having been produced in England by a Mrs. Campbell. The Standard sets down the weights for Khaki Campbells as—Drakes over twelve months, 7 lb to 8½ lb.; ducks over twelve months, 6 lb. to 7½ lb. They are a heavier bird than the Runner, and are regarded as more of a dual-purpose breed.

The Pekins, it is claimed, were first imported into England and America from Pekin about 1873. They differ from other breeds in the shape of the body, having a singular turned-up carriage of the tail, the type suggesting that of an Indian canoe. The Standard weights are—Drakes over twelve months, 8 lb. to 9½ lb.; ducks over twelve months, 7 lb. to 8½ lb. The Pekins, which are more-or-less non-sitters, are well adapted for fattening in confinement, their flesh is very succulent, and if bred systematically for egg-production they prove very prolific layers.

Where suitable environment is available, quite a few people in New Zealand could add to their incomes by keeping a flock of well-bred ducks. While small flocks of ducks have been kept profitably in confined runs, and even when run with hens a few ducks have at times given good results, it is not a good plan to run ducks and fowls together, for if this is done it is almost impossible to keep the yards, especially round the drinking-vessels, in a sanitary condition. Hens and ducks should have separate yards.

For egg-production a good free range is ideal, and on many farms where a suitable range is available a flock of good ducks should prove a good investment. Ducks do well in an orchard, where they destroy many slugs and insects, and benefit from the shade from the trees. On an ideal free range some flocks of ducks are given only one good feed a day during certain months of the year (from about September to January), and that is given in the evening in order to encourage them to return home to their yards. As ducks lay their eggs at night or early in the morning they should be kept in their yards till 9 or 10 o'clock in the morning, otherwise many eggs are likely to be lost.

While a flock of ducks can be kept profitably if suitable environment is available, it is advisable to bear in mind that duck-farming on a large scale is a highly specialized business, which calls for considerable practical experience. The person wishing to undertake duck-culture would be wise to start in a small way, and if the work is found agreeable and a payable market is available for all produce to gradually expand the work as knowledge grows.

Housing and Yards.

Ducks do not require expensive houses; in fact, in many parts of New Zealand no houses are needed, provided the birds have shelter from cold winds, bad weather, and shade from the hot sun. Although they like to forage in damp places ducks should have a dry camping-ground, and if sheds or shelters are erected and the birds shut in at night the essentials to keep in mind are plenty of fresh air, dry floors, and protection against rats. It is advisable to provide plenty of open space, and to cover the front of the house with wire netting. Each duck should be allowed at least 6 square feet of floor-space. It is well to have space enough for two yards, even if the yard is only used at night, for ducks soon taint a small yard. A netting fence, 3 ft. high, serves to keep ducks enclosed, and if stakes are placed just far enough apart to hold up the netting, such fences can be shifted easily when the ground gets stale.

As ducks are inclined to be nervous and timid, it is advisable to select a quiet secluded place for their yards. For instance, cases have come under notice where motor-car lights have disturbed ducks at night, with the result that they gave very poor returns. In order to get the best results they must have quietness, especially at night.

Feeding.

As ducks have no crops, like fowls, the food passes directly to the gizzard. Therefore food best suited for ducks is that which is soft and easily digested. Another point to bear in mind when feeding ducks is that their digestive organs work quickly, and the food they eat has a big influence on the flavour of their eggs. For this reason care should be taken to see that the food they eat is fresh and free from any strong flavour. If care is taken regarding this matter and the eggs are collected early in the morning and not left in the sun or in muddy yards, there would be much less prejudice against the strong flavour of duck-eggs. While ducks fed for egg-production should be well provided for, care must be taken to see that no feed is left to get sour, and it is necessary that they should be fed in troughs or shallow boxes, A good style of duck-feeding trough is shown on page 78 of this Department's publication " Utility Poultry-keeping."

Feeding Laying Ducks.

Most duck-keepers have their own particular system of feeding, and know from experience that it is very unwise to make any change, especially when ducks are in profit.

When ducks have a good range where plenty of animal food and succulent green food is available, they can be given a light feed in the morning before being let out, and a good full feed at night. A suitable plain mixture may consist of two measures of pollard, one measure of bran, and from 5 per cent. to 10 per cent. of meat-meal, according to the season of the year, more animal food to be given during the autumn and winter. The mixture should be given in a crumbly state.

Where ducks are more or less confined, it should be remembered that their food, if on a good free range, consists largely of worms, grubs, insects, and succulent green food, so in order to get the best production from ducks in confinement their food must consist largely of succulent greens and animal food.

A suitable mixture for ducks kept in small yards may consist of 2 measures pollard, 1 measure bran, 1 measure finely cut green or boiled vegetables, and 1 measure of meat-meal, the whole mixed with water or skim-milk into a crumbly state. A regular supply of succulent green food should also be given each day.

Grit and Oyster-shell.

Grit and oyster-shell are even more important for ducks than hens, and a liberal supply of both these essentials should be always within reach of the birds. Even ducks on free range should have a box of grit placed near their camping-grounds or shelters.

Water for Ducks.

Though it is not essential for such breeds as Runners or Khaki Campbells to have water to swim in, better fertility is obtained if they have a pond available. Moreover, ducks consume more water than any other birds, and a supply should be before them at all times. The water-vessels for ducks should be deep enough to enable them to cover their heads and wash their eyes and nostrils when drinking.

Each year many young ducklings are lost with staggers and apoplexy, because a good supply of drinking-water is not constantly before them.

If it is found that the water receptacles are empty when one goes to feed young ducklings, it is advisable to give them a drink first and delay the feeding till after they have had a drink.

Further notes on duck-keeping will be published in next issue.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Moving of Bees.

At this season of the year bees may be moved to a new location with perfect safety. If the work is left until spring, when the activities of the hive commence, the resultant loss of field-bees is enormous. More especially should advantage be taken of the bees' dormant condition if the hives are to be moved short distances only. The colonies are numerically weaker, and there is usually little brood to become injured in transport. When hives are located for any length of time in one position, the flying bees take full observation of every landmark, but as in the winter there are shorter periods of sunshine the flight of the bees is necessarily curtailed, and they usually return at a much shorter distance from the hive. In addition, there are often periods of several days together during which they take no flight at all, and in consequence they must renew their acquaintance with their surroundings when an opportunity for flight occurs. Therefore, if the hives are moved during a spell of bad weather, the bees will take more readily to their new location when a fine day comes. Any bee-shifting operations should be completed before the end of July.

To secure bees for transit over a short distance sufficient ventilation can be provided by tacking a piece of wire gauze over the hive-entrance. It is then necessary to secure only the bottom and roof, and, after making sure that there are no holes through which the bees can escape, the hive may be carried with safety.

The successful moving of bees over long distances calls for considerable preparation. All heavy combs should be secured, and only sufficient honey left in the hives to prevent the bees from starving during their journey. The most important factor is ventilation, and neglect of this matter leads, as a rule, to heavy losses when bees are being moved. The constant vibration of any vehicle tends to disturb the cluster, and the excitement caused thereby is sufficient to raise the temperature of the hive considerably, so that the bees are in danger of being suffocated and the brood scalded. These troubles can be avoided by the employment of wire screens. It is advisable first to see that the frames are made as secure as possible by inserting two wedges between the side of the hive and the top of the end frames. This prevents the frames from rocking during transit. The bottom-board should then be secured to the hive-body by means of crate-staples, driving one end of the staple into the hive-body and the other into the bottom-board. Usually six staples are sufficient. The screens can be made by using narrow laths, nailed together to form a frame of the same dimensions as the hive-body, and covering this with wire cloth such as is used for making queen-cages. The screens must be fastened securely to the top of the hive and the entrance covered with wire cloth. By this means ample ventilation is provided to ensure the safe carriage of the bees during the winter months.

In these days of motor transport the work of moving bees over long distances is greatly minimized, and the beekeeper should adopt this method if he can. In any case, the beekeeper who has occasion to move bees should not relax any effort to make the hives secure when moving to a new location.

Condition of Hive-mats.

At intervals during the winter months the mats should be examined to note their condition. After heavy rain the mats are liable to become damp: damp mats should be removed and dry ones substituted. To save delay a supply of dry mats should always be kept on hand. It is advisable, as far as possible, not to disturb the colonies when making an examination, and especially to avoid jarring the hives. The roof can be carefully lifted and the mat examined. If the latter has to be removed the smoker should be handy in case the bees are troublesome, but it should not be used unless the bees have to be driven down. It is advisable to remove the wet mat as speedily as possible, replace it with a dry one, and cover the hive.

Leaky Covers.

Damp mats usually point to defects in the covers, and it should be worth the beekeeper's while to remove these also. At all seasons the comfort of the bees should be one of the main considerations, and this matter cannot be ignored if successful wintering is to be expected. The labour involved in keeping the hives watertight repays their owner many times over, and prevents to a large extent the loss of heat generated by the bees. One should aim at reducing the waste of energy of the bees by maintaining the heat of the cluster at an even temperature during the unproductive season, and this is impossible where leaky roofs are tolerated. Successful wintering is a high test of the beekeeper's capabilities.

Permanent Shelter.

Now that the actual work of the apiary is off the beekeeper's hands for a while, he may devote his attention to the matter of providing permanent shelter for the hives. If he has definitely decided on a permanent location for the apiary, he should now set about the cultivation of a quick-growing hedge. This matter is a most important one, and ranks next to that of locality. It is noticeable in sheltered situations that the bees are able to take cleansing flights during the mild days of winter, whereas bees in unsheltered positions are often confined to their hives even on sunny days. An occasional flight in the winter is as necessary for the welfare of the bees as any other provision the beekeeper can make for their comfort.

Whatever shrubs or trees are provided for the purpose of producing a permanent hedge, they should be planted thickly, and trimmed to produce abundant foliage, especially at the base. It is highly important that the plants stand cutting-back, so that the hedge can be kept at a reasonable height. Hedges grown to a height of 8 ft. to 10 ft., and no higher, provide ample shelter for a large apiary. There is also less trouble in taking swarms if the trees are kept to the height indicated. Locality and situation must to a large extent influence the beekeeper in choosing the most suitable plants, but, whatever the hedge, the purpose should be to form thick shelter and not a plantation.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Some Soil Pests.

WHERE humus is abundant and tender seedlings are plentiful, a hungry host of insects will often be found feeding upon them unless steps are taken to study the creatures and check their depredations before they become excessive. In shaded moist positions they will be chiefly slugs and snails: in warm sheltered places the crustaceans known as slaters or wood lice are most plentiful. In the more open spaces a dark stout caterpillar, commonly known as a cutworm, the larva of one of the larger heavy-flying summer moths, lies dormant in the soil during the day, but does an enormous amount of harm at night feeding on the roots of young plants, or even cutting them down completely just at the surface of the ground. While small and tender the seedlings are easily injured, and the cause of their slow growth or total disappearance is often unsuspected, so closely hidden are their enemies during the day. Inspection with a torch at night reveals these usually sluggish creatures in a state of great activity, which is a contrast to their behaviour during the hours of daylight. Some protection is often required to enable the crop to grow away quickly or even prevent its total destruction.

Bluestone in any form is most effective in destroying slugs; 18 lb. finely ground and mixed with 3 cwt. kainit or other fertilizer per acre will afford protection. Powdered alum is also a powerful deterrent; or a solution, ½ lb. to a gallon of water, may be sprayed after sundown when the pest is active. The powdered alum mixed with twice its weight of lime and applied at a rate of ½ cwt. per acre is most economical.

For this and other pests mentioned above the most generally useful dressing is a bait composed of 1 lb. paris green and 28 lb. bran thoroughly mixed in a dry state. It is then made into a flakey mash with water and broadcasted towards evening, when the insects become active. Arsenate of lead powder, 2 lb., may be used in the place of paris green. This quantity is sufficient for an acre. It is best applied when the land is fallow, a few days before sowing or planting.

Good reports have been received of a new slugicide made of one pint of bran mixed with one "meta" tablet finely ground. These tablets, used for heating, are composed of metaldehyde and obtainable from chemists. They are not soluble in water. The remedy is useful in home gardens where a poison bait may be objectionable.

Vegetable Crops.

It is usually towards the end of the month of July before much can be done with annual vegetable crops. On sheltered light land, and elsewhere where it is warm, a commencement may be made by planting out shallots, garlic, cabbage, and cauliflower; also sowing early peas, spinach, and salads. Of the perennial crops, rhubarb may then be planted, but asparagus is best left until the following month.

Of all the factors contributing to a good crop, the application of artificial fertilizers is one which receives considerable attention. This powerful aid to good cropping requires very nice adjustment to obtain the best results. It is not merely a question of obtaining a chemical analysis of the soil and making good the deficiencies by use of chemical fertilizers; the heavier dressings of fertilizers are often applied to the richest land. The results of high feeding may be heavy crops, exceptional quality, or serious loss from disease, the latter usually occurring when the application is badly balanced as to its ingredients, the application is badly timed, or may be unsuited to the soil or the crops. Extremely heavy applications of fertilizers are to some extent a gamble, and they should be made only by those with a long experience of a locality. The result depends very largely on the weather experienced after the application is made. Under most circumstances it is best to apply a moderate dressing before sowing and planting, and side dressings afterwards as may be required; then if the drainage is good and the lime requirement of the soil is watched the best results from the fertilizers may be expected.

The kind and quantity of fertilizers to be used with each crop must be carefully adjusted after considering all the circumstances. For crops of the cabbage family 3 cwt. to 6 cwt. of superphosphate and 1½ cwt. to 3 cwt. of sulphate of potash worked into the land before planting will often be satisfactory where a good dressing of farm manure has been turned under in the preliminary preparation. Where farm or stable manure has not been used, half a ton or so of blood and bone or fish manure should be incorporated during the preparation of the land. If 1 cwt. or 2 cwt. of nitrate of soda are applied as a side dressing when the plants are established and this is repeated when they commence to heart up it will often be found satisfactory. Somewhat similar treatment is suitable for salad crops. Where the land is heavy 1 cwt. or 2 cwt. of sulphate of ammonia may be included in the dressing before planting and the first dressing of nitrate of soda omitted. Culinary peas, like most other crops which are required to flower and seed, do not require so much nitrogen as the preceding. Where the land is in good heart from previous dressings the superphosphate and potash quantities mentioned above will probably meet their requirements. In preparing land for rhubarb a heavy dressing of farm manure is turned under and 3 cwt. to 6 cwt. superphosphate per acre is worked in before planting.

Small and Sundry Fruits.

In the warmer districts the tomato crop under glass is planted out towards the end of July—in middle districts about the end of August. During recent years it has been necessary to stress the damage caused by the excessive use of stable manure before planting out this crop. The danger is greatest where the water-table in the subsoil is comparatively high, or where the land is heavy and drainage is inclined to be defective. It is, however, necessary, to maintain fertility, to keep up a supply of humus in the soil by means of stable manure or cover-crops. The need will specially require to be watched where the subsoil is open and where steam sterilization of the soil is practised. In preparation for planting a dressing of artificial fertilizers should be worked in two or three weeks previously. In the absence of local data the following moderate dressing may be used to the square yard: ¼ lb. bonedust, 2 oz. superphosphate, and 2 oz. sulphate of potash.

In preparing the tomato-plants for setting out it will generally be advisable to fumigate them with nicotine to destroy aphides. Insect infestation is generally the main cause of virus disease in this crop under glass, and treatment is more easily given before than after planting out.

Planting-distances are important; they should be widest in warm humid localities especially where ventilating facilities are limited, as is so often the case. Under such circumstances 12 in. between plants and 30 in. between rows will not be excessive, but in any case the rows should not be closer than 24 in. to obtain the best results.

About the month of July, as autumn-planted strawberries commence to make growth, a small dressing of blood and bone manure worked into the ground between the rows will usually be beneficial; a little superphosphate may be included if desirable; established beds may be given a similar dressing. Two or three such dressings at intervals will build up the plants for heavy cropping. In at least one dressing 1 cwt. per acre of sulphate of potash should be included in the mixture.

The quality and demand for persimmons, Cape gooseberries, and tree tomatoes on the market at the present time suggest that more attention might be given to the production of these and other kinds of fruit that are not usually grown. It is evident we have not fully realized the possibilities of the resources we have in the land and climate of New Zealand, especially in the warmer, sheltered localities. Avocados, feijoa, and figs are also produced in excellent varieties and quality, and planting might well be extended where they are doing well. Up to the present avocados have borne fair crops in the Gisborne district only, and some pioneer work still remains to be done, more particularly in the matter of variety trials. It is a very wholesome fruit and when the public have acquired the taste it should be in good demand. This is the planting-season, and consideration might be given a practical turn by making arrangements for planting during the months of August and September, if only a few trees, of this class as an experiment.

The Homestead Garden.

Where new gardens are being made the formation should be pushed ahead as weather permits, so that it may have time to consolidate before sowing down the lawns during the months of August and September. It is important that the surface should be at the right height, that it should be smooth, that the grade should fall away from the dwelling, and all surface water properly accommodated. These points should be verified positively before sowing the seed. An alternative method is to make new lawns by laying turfs. For small gardens where the area of the lawn is limited this method is very suitable ; also in making minor alterations in an established garden, as when turfing-down old borders or making new beds. Worn patches in a lawn, about the centre or verge, are best repaired by turfing—in mild weather when the land is sufficiently dry.

Consideration should now be given to the pruning requirements of plantations, shrubberies, and climbing plants. In many parts of the country trees mutilated by careless pruning are an unpleasant spectacle, and their value as timber or for shelter purposes is seriously discounted. With systematic attention there should rarely be a necessity to remove large limbs : where it does occur the cut should be clean and flush with the trunk, or just beyond a good lateral growth To do this a sharp saw is required and an under-cut should be made first, so that when the limb is severed from above it will fall without ripping the bark. If Stockholm tar or a thick paint is then applied to keep out moisture and decay, the tree will be preserved, and also its appearance and usefulness so far as possible.

The necessity of such major operations arises through encroachment or congestion, and when examining trees and shrubs now such developments should be prevented by the timely removal of the branches causing it while they are comparatively small. Congestion or crowding of the branches, especially about the centre or the base of hardwood plants, is unsatisfactory and should be given attention from the commencement when the plants are first set out.

Where, in addition to this, pruning is done to encourage the production of flowers, and possibly fruit, the habit of the plant must be more closely studied to ascertain, for instance, whether the flowers are produced on new wood, as in the case of roses, bougainvillea, and so many others ; or on young wood that is of last season's growth, as in peach and weigela ; or on spurs on the old wood, as in apple and wistaria. The shrubs and climbers grown for blossom should be closely studied from this point of view while at the same time realizing that such subjects usually require rather generous feeding to enable them to maintain the display.

In most plantations and shrubberies the annual mulching of leaves which fall from the trees in autumn or spring is sufficient to feed the roots, but in the case of the more ornamental sections, where much blossom is expected, a dressing of bonemeal and well-decayed farm manure will be of great assistance. This should be worked in by means of shallow cultivation, as any serious disturbance of the roots is injurious.

—*W. C. Hyde, Horticulturist, Wellington.*

SEED-WHEAT CERTIFICATION.

FOLLOWING is a list of growers for the month of May whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably sealed and tagged. (Previous lists, to which those interested are referred, appeared in the March, April, and May *Journals*) :—

Variety.	Grower.	Acreage.
Cross 7	Anderson, J., Southburn	8
	Boag, P. M., Winchmore, R.M.D.	20
	Borrie, P. W , Waihao Downs	17
	McLeod, J. A., Tycho, R.M.D., Timaru ..	50
	Manchester, J., Waimate	20
	Pearce, B. V., Methven	17
	Symes, O. W., Lyndhurst	25
Dreadnought ..	Austin, K., care of Elderslie Stud, Ltd., P.B., Oamaru	10
	Barnett, A. W. Morven	8
	Daly Bros., St. Andrews	20
Hunter's II ..	Marshall, W. J., Gleniti, Timaru	13
Solid Straw Tuscan	Brophy, J., Pleasant Valley	12

—*Fields Division.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 6th May, 1937, to 3rd June, 1937, include the following of agricultural interest :—

No. 75679 : Spraying-gun ; R. A. Snelgrove. No. 75972 : Wool-dusting machine ; F. Young and Co., Ltd. No. 76512 : Manure ; E. C. Nuske. No 76051 : Milking-machine ; New Zealand Express Co., Ltd. No. 76153 : Milking-machine ; F. A. Stempa. No. 76379 : Weed-killer ; Chipman Chemical Co., Ltd. No. 76810 : Fencing-post ; H. W. James. No. 77368 : Sheep-shearing-machine hand-piece ; Wolseley Sheep Shearing Machine Co., Ltd No. 75282 : Ice-cream machine ; H. Sandlant. No. 76445 : Holding cow's tail during milking ; J. W. Baxter. No. 76639 : Fruit-mixing apparatus ; Barron-Gray Packing Co. No. 76729 : Spray-pump ; R. L. W. Robinson. No. 77370 : Milk-measuring means.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid

DEPARTMENT OF AGRICULTURE.
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WEATHER RECORDS: MAY, 1937.

Dominion Meteorological Office.

NOTES FOR MAY.

THOUGH not particularly severe, the first part of May was cold and rather stormy. After the first week there was rather more snow than usual on the mountains. From then onwards mild weather prevailed, the conditions in the last twelve days often being almost summer-like. Rainfall was above average in most districts, and especially so over most of the South Island and the Auckland Province. The sky was cloudy and the atmosphere humid, so that even where the rain was below average moist conditions prevailed. This state of affairs was accentuated by the absence of wind during the second half of the month. Grass has continued to grow, so that there is everywhere abundant feed for stock, which are reported generally to be in good condition. The state of the pastures has been very favourable to the dairying industry, but less so for fattening stock. In the North the somewhat stormy conditions and the lack of sunshine caused the growth of most vegetation to be checked, but in the rest of the country growth was unusually vigorous for the time of year. Numbers of trees and shrubs are flowering out of season. The ground is in most districts too soft for ploughing and the sowing of crops.

Rainfall.—In the North Island the total rainfall was considerably above average from Auckland northwards and in parts of the Bay of Plenty and central areas and the South Taranaki Bight. East of the main ranges, in western Taranaki, and in southern Wellington, it was below average. Over the South Island the month was a wet one, except about the Canterbury-Marlborough border and in the extreme South.

Temperatures were about normal in Nelson, Marlborough, and North Canterbury, but above it almost everywhere else. The departures, except at some inland stations, were generally less than a degree. There was some cold weather in the first week, but thereafter, and especially after the 19th, it was very mild. There were few frosts, and none very severe.

Sunshine was much below average in the North Island, especially the northern portion. Christchurch and Hanmer Springs reported slightly more than average, but elsewhere in the South Island also there was less than normal. Blenheim had 147·5 hours, Napier 143·3, and Wanganui 142·5.

Pressure Systems.—During the first four days the westerly type of weather prevailed, strong winds blowing from between north-west and south-west, with frequent rain in districts with a westerly aspect, and some snow and hail on the ranges. During the 4th, conditions became particularly boisterous, with widespread westerly gales. Severe thunderstorms occurred in many places west of the ranges, hailstorms were numerous, and heavy snow fell on the ranges.

After a brief spell of anticyclonic weather another westerly depression brought north-west to westerly gales to many places on the 8th to 9th. Some heavy rains were recorded, especially in the ranges.

On the 11th an anticyclone moved on to the Dominion, and fine weather prevailed. By the 13th the anticyclone was centered to the eastward, and had become rather intense. Strong north-easterly winds set in over the northern part of the North Island. A cyclone gradually formed near Norfolk Island, and travelled southward across New Zealand before dying out on the 17th. It was responsible for dull and misty conditions and widespread rain.

Depressions of minor intensity passing on the 19th and 23rd brought heavy rain to a few districts, and a shallow cyclone centred to the west caused rather stormy weather in North Auckland on the 27th. Generally speaking, however, quiet conditions prevailed from the 17th onwards.

RAINFALLS FOR MAY, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Fall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	7·06	19	1·75	6·61	28·76	21·57
Russell	14·09	17	4·20	7·09	43·29	23·95
Whangarei	9·16	19	2·34	7·88	33·36	25·06
Auckland	7·04	23	1·48	5·15	18·74	18·84
Hamilton	7·09	18	1·60	4·70	20·73	18·79
Rotorua	8·98	15	3·30	5·69	25·79	21·62
Kawhia	4·92	15	0·77	5·34	17·61	19·82
New Plymouth ..	4·72	18	0·90	6·20	26·16	22·59
Riversdale, Inglewood ..	10·16	16	2·29	9·69	45·61	38·38
Whangamomona ..	10·54	12	2·10	6·84	34·83	27·81
Hawera	3·37	17	0·63	4·58	19·57	16·98
Tairua	5·41	21	0·94	7·08	22·22	26·59
Tauranga	5·22	15	1·03	5·10	25·28	21·53
Maraehako Station, Opotiki	7·51	11	2·75	5·70	28·73	22·13
Gisborne	1·70	8	0·68	5·36	13·87	20·01
Taupo	4·83	16	1·53	3·95	16·20	16·80
Napier	1·34	9	0·44	3·18	8·59	13·16
Hastings	1·08	10	0·56	3·29	5·74	13·56
Whakarara Station ..	..	..	..	..	..	..
Taihape	3·07	18	0·61	3·47	14·82	14·43
Masterton	3·01	14	0·94	4·04	13·04	15·18
Patea	4·16	20	0·71	4·15	20·92	17·16
Wanganui	3·89	12	0·90	3·34	17·36	14·33
Foxton	3·15	15	0·50	3·19	12·13	11·88
Wellington	3·41	16	1·10	4·10	15·33	16·58
South Island.						
Westport	7·13	18	1·27	8·35	39·44	37·65
Greymouth	11·09	20	2·82	8·10	52·14	40·76
Hokitika	10·77	20	2·21	9·58	55·05	45·87
Ross	13·66	17	4·44	9·83	66·61	54·04
Arthur's Pass ..	14·26	14	5·43	12·78	72·46	65·41
Okuru, South Westland	17·42	9	3·00	10·80	76·82	61·32
Collingwood	12·42	16	3·19	8·87	43·96	34·80
Nelson	5·44	16	1·12	3·26	17·36	14·81
Spring Creek, Blenheim	4·50	13	1·70	3·03	13·39	11·53
Seddon	4·02	12	1·59	2·83	11·46	10·23
Hanmer Springs ..	3·08	14	0·80	4·54	12·66	18·38
Highfield, Waiau ..	1·86	8	0·49	3·25	8·19	14·27
Gore Bay	4·84	10	1·64	3·41	13·14	13·18
Christchurch . ..	2·94	..	0·75	2·62	10·08	10·10
Timaru	2·37	14	0·39	1·48	12·27	9·39
Lambrook Station, Fairlie	1·97	11	0·77	1·57	10·81	10·12
Benmore Station, Clearburn	2·40	15	0·57	1·79	15·34	10·99
Oamaru	2·10	11	0·64	1·60	9·19	9·00
Queenstown	3·33	15	0·71	2·59	16·18	13·13
Clyde	2·00	10	0·49	0·99	9·90	6·84
Dunedin	4·33	15	1·02	3·15	23·32	14·94
Wendon	3·27	15	0·84	1·98	25·64	12·89
Balclutha	2·96	16	0·66	1·92	19·48	10·72
Invercargill	3·69	24	0·52	4·36	21·93	19·67
Puysegur Point ..	5·45	23	0·88	6·67	42·28	35·67
Half-moon Bay ..	4·54	19	9·70	4·85	29·22	24·22

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PIG INDUSTRY.

THE PRINCIPAL BREEDS.

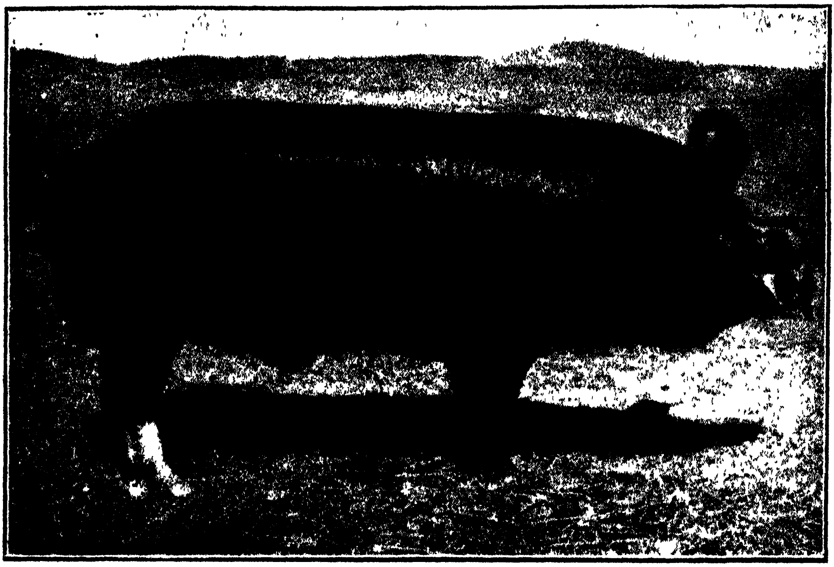
M. J. SCOTT, Superintendent of the Pig Industry.

ADVOCATES of the different breeds of pigs found in New Zealand may be disappointed because the virtues of their particular breed are not sufficiently stressed in these notes. It is now generally recognized that every breed possesses certain strains that can produce the kind of animal that is required, and the sooner it is admitted by everyone that pigs suitable for the English trade are to be found in every breed, and the sooner one breed, or at most two, are selected for the production of commercial pigs, the sooner will New Zealand pigs be keenly sought after on the English market. The improved demand for New Zealand pigs will arise from an improvement in quality associated with an improvement in uniformity, and uniformity is most important When there are many equally good, but slightly different, articles offered to a buying population, business tends to be sluggish ; each buyer is watching the others to be sure that no small point is missed, and all are hanging back till a certain fashion is established Offer a buying public an article that is the same to-day, to-morrow, in all shops and markets, and it tends to buy freely of the best that is offering. Only the best is good enough, and the moral for the producer seems to be " have only one best and no worst."

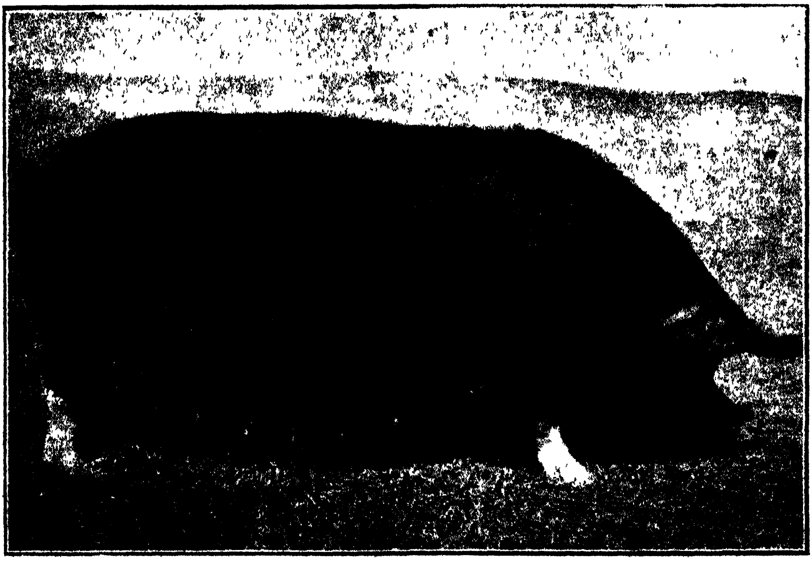
THE BERKSHIRE.

The Berkshire is the best-known breed in New Zealand, and the majority of grade sows have a dash of this blood in them. They are looked upon as a hardy pig and a good doer. While this was a virtue in days gone by, and was shown by the way in which the pig piled on fat on the crest of his neck just between his ears and the top of his shoulder-blades, that same class of pig is not so desirable to-day except for the pork trade, or for the pig-jobber who does not care what kind of pigs he produces so long as they do well and get off the place. This type of Berkshire has been replaced in the stud world, almost entirely, by a longer, leaner animal that produces almost as good a carcass as the best of baconer breeds do. Berkshires make excellent porkers, but the fact that they are black discounts them somewhat on the English pork market. Baconers are not objected to because they are black as the operation of singeing removes the colour objection. The importation

Berkshire Types.



BOAR (ROYAL CHAMPION, 1932).



SOW (ROYAL CHAMPION, 1932).

[*N.Z. Farmer Weekly photos.*

some ten years ago from Canada of strains of Berkshires whose length, fine shoulders, and splendid hams made them highly suitable for the bacon trade did much to bring the Berkshire breed back into the public mind. If only the Canadian strains were more fixed for colour and "points-appearance," they would be entirely acceptable.

The Berkshire is one of the oldest of the improved breeds. It originated in County of Berkshire, England, but principal improvement in it was made in Leicestershire and Staffordshire. The original animal was large, similar to the Tamworth, coarse of body, and the colour varied. Marked improvement developed early in the eighteenth century, and was principally effected by Richard Astley and Lord Barrington. The first-known pedigree dates from 1859. Berkshires were first to be given a separate class at the Royal Agricultural Show, England, in 1862. The first herd book was issued in 1885. Early writers show that Chinese pigs were crossed with the Berkshire in their improvement. The improved Berkshire was greatly used on native swine in Ireland and Scotland, with beneficial results. This breed is most widely distributed and popular throughout the world, and does well in all climates.

Quality of Meat.

The Berkshire is noted for the high quality of its meat and the high proportion of the most profitable cuts which it yields. It is a producer of lean meat of the highest quality. The fact that the Challenge Cup for the best single pig of all breeds at the Smithfield Show has been awarded to Berkshires twenty times and to Berkshire crosses twice in forty years, and that the championship for the best pen of two pigs of all breeds was won by Berkshires twenty times and by Berkshire crosses eight times in forty-five years, affords further proof, if such were needed, that the breed is more than able to hold its own with others for early maturity. Weight for age is one of the prime requirements of judging at Smithfield; it is obvious that the breed would not have reached the top on so many occasions unless it had proved itself of inestimable value as a converter of food into meat in the least possible time.

Berkshires are hardy and may be relied upon to thrive under almost all conditions. In the Argentine, Australia, and New Zealand, countries in which the commercial aspects of live-stock breeding are alone of importance and where the most up-to-date methods are successfully employed, Berkshires constitute nearly two-thirds of the pure-bred population. This is a striking tribute to the suitability of the breed for all climates and conditions. In South Africa and Canada Berkshires are second in order of popularity; and they are found in increasing numbers in Central Europe, Japan, India, and the Malay States, as well as in Brazil and many other parts of the world. In the United States of America Berkshires have their own breed society, and it may be mentioned that at the International Live-stock Show, Chicago, held annually, Berkshires have sired over thirty champions and have won first prize in one or more classes twenty out of twenty-two years, a record unrivalled by any other breed.

Suitability for Crossing.

The value of the Berkshire breed for crossing purposes, especially when sows are crossed with a Large White boar, is widely recognized. Whether either the boar or sow is used to mate with other breeds, the progeny may be relied on to bear the stamp of the Berkshire's fine quality and to inherit its early maturing properties.

The standard of excellence for the breed, which was revised in 1928, is as follows:—

Character.—A combination of the following definitions, denoting type, quality, breeding, and masculinity in the case of boars and femininity in the case of sows and gilts.

Head.—Moderately short, face dished, snout broad. Wide between the eyes and ears. Ears fairly large, carried erect or slightly inclined forward and fringed with fine hair. Jowl light.

Neck.—Fine, evenly set on shoulders and free from wrinkles.

Shoulder-blades.—Fine and well sloping. Special notice to be taken regarding this point in the case of females.

Legs and Feet.—Short, straight, and strong, set wide apart, standing well on toes, and a good walker.

Back.—Long and level. Tail set high.

Sides.—Level and deep, ribs well sprung.

Hams.—Broad, wide and deep to hock.

Belly.—Thick, with straight underline, and deep through the heart.

Bone.—Well developed in males and fine in females.

Flesh.—Firm without excessive fat.

Skin.—Fine and free from wrinkles.

Hair.—Long, fine, and plentiful, with absence of mane, especially in females.

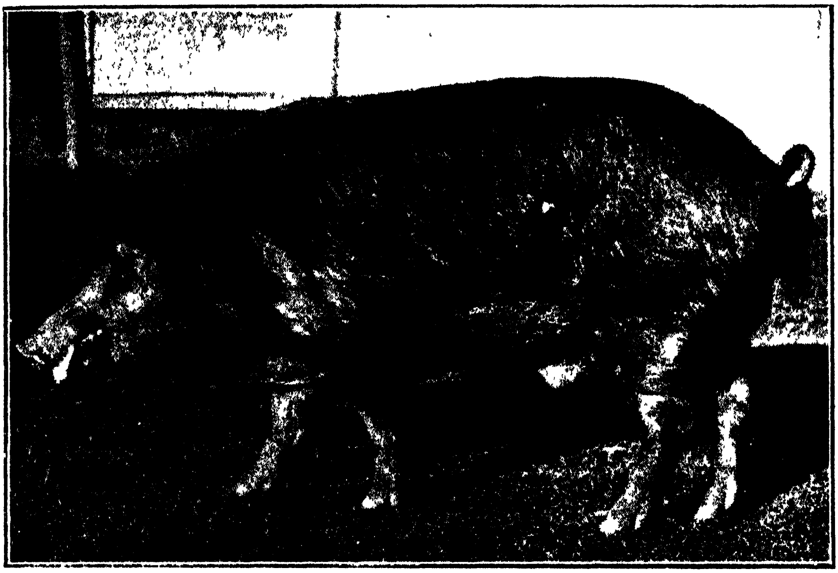
Colour.—Black, with white on face, feet, and tip of tail.

Imperfections.—Crooked jaw. Rose back.

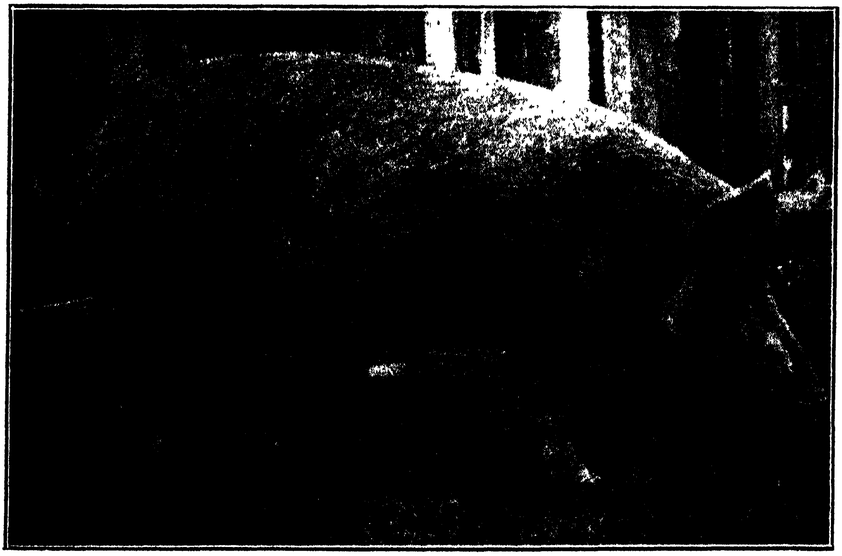
THE TAMWORTH.

Next in popularity to the Berkshire and gaining rapidly on it is the Tamworth breed. Being a bacon pig and one of the oldest of the established breeds it has blended with the Berkshire to make a better bacon pig, and the offspring have shown the distinctive Tamworth characteristics of hardiness and ability to look after themselves in a most pronounced way. The demand for leaner bacon during the past twenty years has been a great factor in bringing the Tamworth breed into prominence and displacing some of the more refined breeds. The natural stamina, prolificacy, and grazing-capacity of the Tamworths, combined with the great delicacy, firmness, and succulence of their flesh for bacon, commend them to the farmer in this country, where pasturage and open grazing are abundant. The breed has the reputation of being slow in maturing, but such has not been the case in New Zealand. Evidently the nature of the climate has produced a reaction towards quick maturity, and in experiments carried out the Tamworth has more than held its own with other breeds. Where the Tamworth has proved specially valuable is in crossing with other breeds and further imparting vigour, size, and prolificacy to half-breds as produced. Tamworth sows are good mothers and free sucklers. They are also noteworthy for the facility with which they farrow, and the small trouble they have in rearing large litters. Again, Tamworths have acquired a reputation for docility. They are easily managed, and do not show any disposition to be ill-tempered.

Tamworth Types.



BOAR (ROYAL CHAMPION, 1936)



SOW (ROYAL CHAMPION, 1932).

[*N.Z. Farmer Weekly photos.*

Tamworths derive their name from the town of that name in Staffordshire, England, where they have been bred for a long period. They are probably the oldest and purest of all breeds in England, a circumstance that probably accounts for the wonderful marked prepotency of the Tamworth. At the beginning of the eighteenth century they were noted for large proportion of lean meat they produced. Have been greatly improved by selection, but it is generally conceded that no mixture of the breeds has been introduced in improvement. As early as 1847 they were given premier honours in competition with other large breeds at Royal Agricultural Show, England. Following this they went out of favour, but regained popularity from 1880 onwards.

Principal Points.

The principal points of the Tamworth are as follows :—

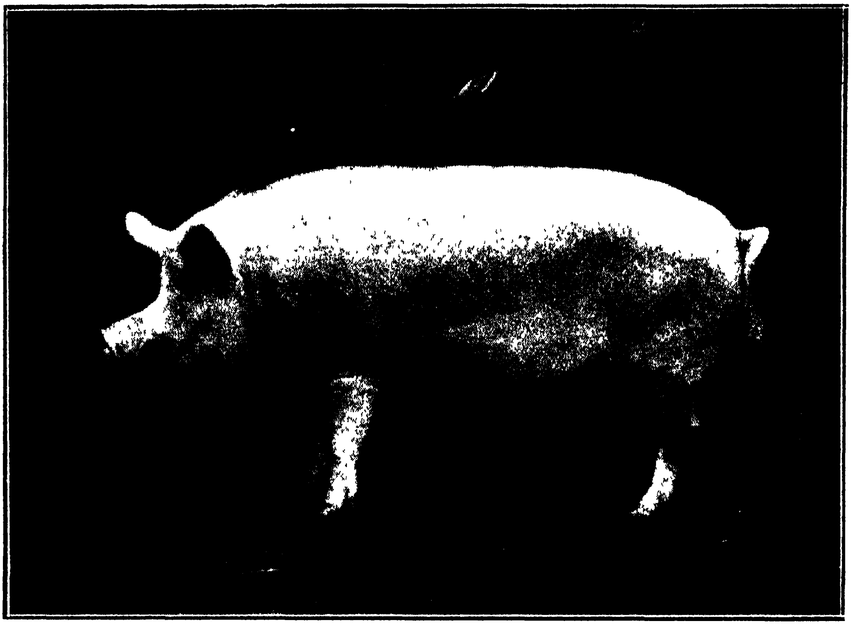
Head.—Long, lean, light, tapering to snout.
Ears.—Moderate size, fairly erect, pointing forward.
Jowl.—Light.
Neck.—Long, rather deep than wide, tapering.
Shoulders.—Sloping, good thickness through heart.
Back.—Moderately wide, long, slightly arched.
Barrel.—Long in coupling, deep ribs, well sprung.
Rump.—Deep, fairly full, rounded.
Ham.—Large, gradually rounded off rather than square.
Legs.—Moderately long, strong, firmly placed under body
Skin.—Smooth, plentifully covered with hair.
Hair.—Freedom from coarseness.
Colour.—Bright golden red, no black.
Objections.—Shoulders coarse, open at top, ribs flat, weak coupling, shallow body.
Disqualifications.—Black or white hairs. Black skin.

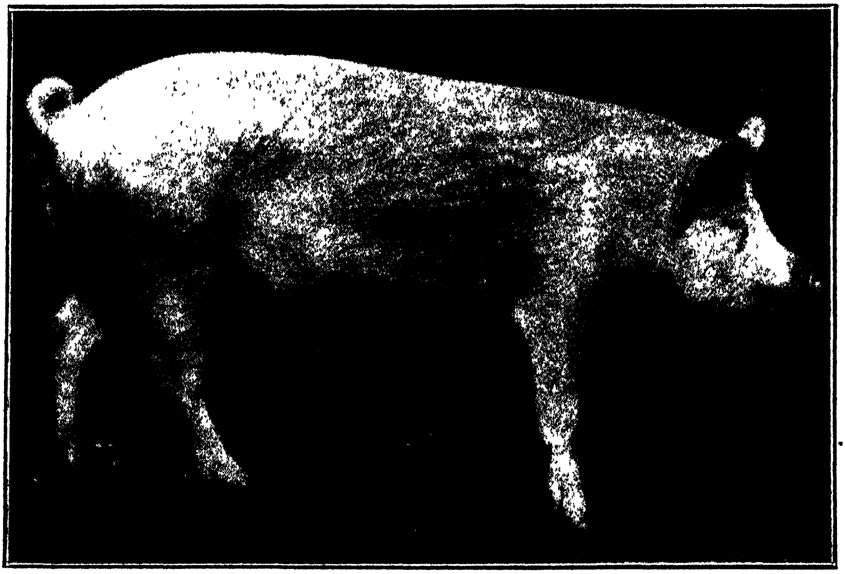
THE LARGE WHITE.

This is the world's bacon pig. In every country that is seriously producing bacon either one or else both the parents are Large White pigs. The White pig is the pig of the cold countries of the world, and, while this might infer considerable hardihood on the part of the White pig, it probably means a close association between these cold country people and their pigs. Possibly the White pig was well housed and cared for in these climates. Some say the Large White is a selection of the White Yorkshire pigs, the Small White being a selection from the same source. Other origins are attributed to these breeds, the Middle Yorkshire being reputedly a cross between Large and Small White Yorkshires. On the whole, New Zealand experience of White pigs has not been a happy one, although there are numerous exceptions to this generalization. Many have had White pigs that scald badly in hot weather or even in very rainy weather. When kept in the open, they are not always satisfactory, but it is an almost universal experience that the same pigs kept inside on warm beds grow more rapidly than any other breed or cross.

The Yorkshire originated in Yorkshire, England. It is bred from the old English hog, a large white animal. The Small Yorkshire owes its refinement to Chinese crosses, and the Middle Yorkshire to a cross

Large White Types.

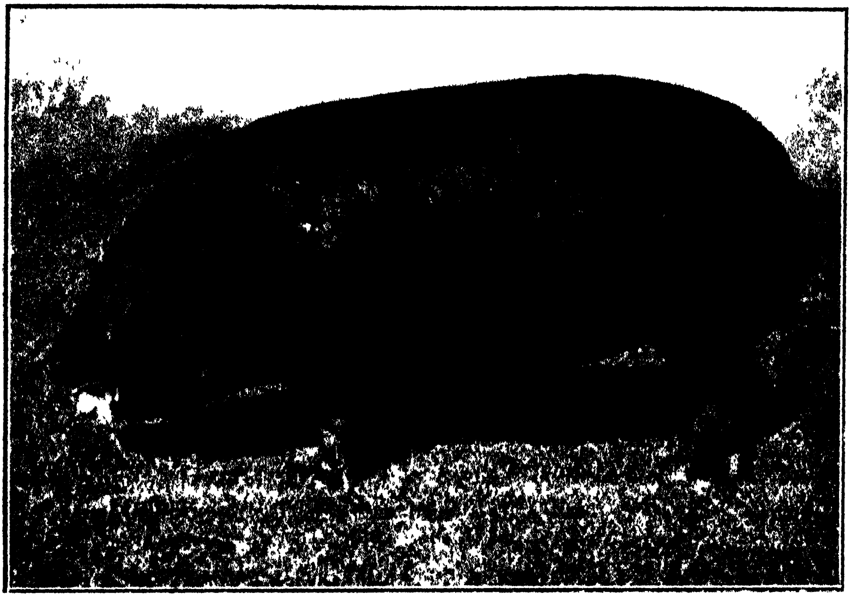




SOW (ROYAL CHAMPION, 1934).

[*N.Z. Farmer Weekly photos*

Large Black Types.



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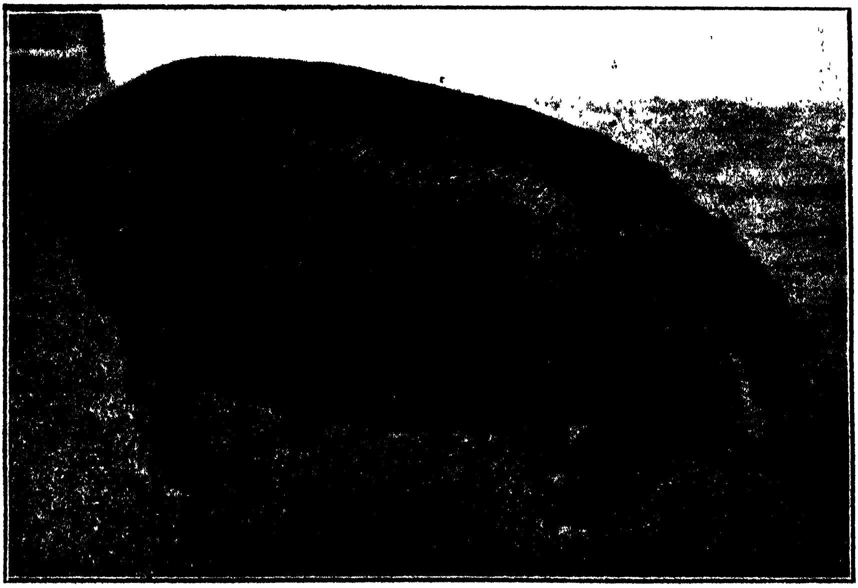

SOW (ROYAL CHAMPION, 1936).

[*N.Z. Farmer Weekly photos.*

between the two. The Middle Yorkshire was classed separately in 1852. Improvement commenced about one hundred and fifty years ago. Yorkshire blood is widely diffused throughout the world in all white breeds.

Principal Points.

The principal points of the Large White are as follows:—

Head.—Long, lightish, wide between eyes, face dished.
Ears.—Long, fine, inclined forward
Jowl.—Light.
Neck.—Long, muscular.
Shoulders:—Sloping, no coarseness.
Back.—Long, wide, straight or slightly arched
Barrel—Deep, full-rounded, well sprung ribs, flanks well let down, long, wide, square
Hams.—Broad, full meat to hocks
Legs.—Straight and strong
Feet—Firm
Skin—Cream colour, freedom from wrinkles or dark spots.
Hair—Long, straight, fine
Colour—Pure white.
Objections—Ears coarse, flopping; shoulders, coarse; weak back, unshapely hams, weak loins, crooked legs; weak feet, coarse, curly hair; action, sluggish
Disqualifications.—Black or red hair or spots on skin

LARGE BLACKS.

Large Blacks are essentially bacon pigs. It is only with difficulty that they can be turned off as porkers. They are not sufficiently developed at the porker weight to produce a suitable carcass, being thin on the flank and usually loose over the loins. They are noted for their placid disposition and ability to forage.

Their origin is veiled in obscurity. There is no evidence of mixture of breeds. For generations the Large Black was the only pig known in Devon, Cornwall, Suffolk, and Essex. Its first herd book was started in 1899.

Outstanding Points

The outstanding points of the Large Blacks are as follows:—

Head.—Medium length.
Ears.—Long, wide, falling over face, fine in texture.
Jowl.—Medium.
Neck.—Fairly long.
Back.—Long, broad, inclined to arch.
Sides.—Very deep.
Ribs.—Well sprung.
Barrel.—Ample capacity.
Hindquarters.—Long, wide, not drooping overmuch.
Hams.—Large and well filled.
Legs.—Comparatively short, straight, well placed.
Skin.—Fine, mellow to touch.
Hair.—Somewhat sparse, fine silky.
Objections.—Head, narrow, dished nose; Skin and hair, coarse or curly.
Disqualifications.—Ears, thick, coarse, or erect; colour, other than whole black.

Next month the breeding of pigs will be discussed.

ARTHRITIS IN LAMBS.

A paper read by W. C. BARRY, Director, Live-stock Division, Department of Agriculture, at the Sixth Annual Meeting of Sheep-farmers held at Massey Agricultural College, June, 1937

THE disease known as arthritis in lambs has been observed in New Zealand for years past, and many sheepowners are familiar with the lameness produced in young lambs by this joint infection.

Arthritis means inflammation of a joint. The actual lesion varies from a simple excess of synovial fluid or "joint oil" to a condition of thickening of the tissues of the joint capsule. The articular cartilages of the joint are sometimes involved, when erosion takes place. In chronic cases there is seen permanent enlargement with accompanying stiff joint. In a minority of cases of arthritis pus is found in the joint, but in those cases the infecting agent is usually one of the pus-producing organisms—streptococci or staphylococci. This form is, however, comparatively uncommon. In a majority of cases no pus is found in the joint, but the synovial fluid is increased in quantity in the early stages. It is with this form of arthritis, which is due to a specific organism, and which is by far the most common type of the disease met with, that this paper deals.

The disease is sometimes referred to as "joint ill," or polyarthritis of lambs. Its distribution appears to be world-wide. In England the disease was studied in 1925 by Glover and Cornell at the Institute of Animal Pathology, Cambridge. It has been described in Germany. In Montana, United States of America, the disease has been intensively studied by Marsh; in Australia by Seddon, Carne, and others; and in New Zealand by Hopkirk and Gill at the Wallaceville Laboratory, who in 1930 published a most interesting *résumé* of their investigations into the disease in this country. They then recorded for the first time in New Zealand the association of a particular germ—very similar to, if not identical with, that which causes swine erysipelas in pigs, and known as *Erysipelothrix rhusiopathiae*—with arthritis of lambs. It must not, however, be assumed from this that the disease is in any way connected with the pig, as swine erysipelas is practically unknown in New Zealand. The finding of a similar organism in cases of lamb arthritis was later recorded from other countries.

ECONOMIC IMPORTANCE.

Arthritis of lambs is of considerable economic importance. It results in the partial condemnation of a large number of lamb carcasses at freezing-works during the killing season, the most commonly condemned portion being the leg, the stifle and hock joints being the most frequently involved. Along with enlargement of those joints, wasting of the muscles of the part occurs, spoiling the appearance of the leg. The knee is also frequently found affected. Meat-inspection records at freezing-works indicate that 0·138 per cent. of lambs are affected with arthritis. This means that for a season's killing approximately twelve thousand lambs are found affected with arthritis in some degree. Apart from the waste occasioned by condemnation of parts of affected carcasses, the disease is also responsible for economic loss to the sheepowner through the setback which it brings about in affected lambs in a flock. Even when lambs are only very slightly affected and no symptoms are evident beyond a slight stiffness, which passes off in a few days, nevertheless such lambs receive a check in condition from which it takes them considerable time to recover.

The most susceptible age is up to three or four months, and the most common time when lameness among lambs is noticed is about a week to a fortnight after the lambs have been marked. The disease is occasionally seen in a flock before marking, but the majority of cases occur after that operation The breed of sheep does not appear to have any relation to the disease ; it occurs in lambs of all breeds. It is held that a larger percentage of cases occur in wether lambs, and this is to be expected as the disease is generally supposed to be a wound infection, the inference being that the castration wound, in addition to the docking of the tail, offers an increased avenue of entry to the germ

SYMPTOMS OF DISEASE.

The symptoms of the disease are fairly well defined, and no great difficulty is experienced in diagnosis. Its onset in a flock of lambs is usually sudden The owner notices a number of lambs affected with lameness in one or more limbs, and examination will reveal tenderness of the joints—usually the stifle, hock, knee, and elbow It must, however, be remembered that stiffness and lameness can be present without enlargement of the joints—the latter symptom is not seen at all in a large percentage of the cases. The lamb shows evidence of pain when attempting to place weight on the affected leg. There is consequently disinclination to move, and, as a result, rapid loss of condition through partial starvation. From the first acute symptoms a sub-acute form is developed, and a small percentage of lambs become chronically affected. Complete recovery, however, usually takes place in probably 80 per cent. of the cases within a month of the onset of symptoms. Mortality might occur in a small percentage of cases, and is probably the result of generalized infection. In the chronic cases deformity of the joints usually results

The organism which causes the disease is generally believed to gain entrance to the circulation through a wound—either the freshly ruptured or unhealed navel, docking, castration, or ear-marking wounds. Having entered the circulation the germ appears to have a predilection for the joints, where the characteristic lesions are set up. The large number of cases which occur about a week following marking would strongly support the view that it is a wound-infection. In the cases which occur in younger lambs, and before marking, there is every reason to believe that the infection gained entrance through the navel.

INTERESTING EXPERIMENTS.

In connection with the manner of infection, some interesting experiments were conducted by Hopkirk and Gill in 1928. An extract from their report is as follows : " Two ram lambs had the freshly-cut castration wounds sprayed with a culture of the organism, and three ewe lambs had the freshly-made docking wounds similarly treated. One ram lamb and three ewe lambs marked at the same time acted as controls. Lameness was noted in each of the three males and in two out of the six females by the fifth day. The females showing lameness were two of the three whose docking wounds were sprayed. These nine lambs were operated upon in a small enclosure and the spray was made by an ordinary atomizer. As none of the lambs from the rest of the flock which were marked at the same time, but in another yard, showed any such symptoms it seems fair to regard them as controls and assume that the control male lamb which evinced arthritis was accidentally infected as a result of the spraying of the others. All marking wounds, sprayed and otherwise, healed quickly and normally without treatment. One ewe lamb showing obvious lameness at the expiration of three weeks was killed, and post-mortem showed acute arthritis of the limb joints. The specific organism was obtained in pure culture from one lamb, but the other two gave mixed growths. The other four affected lambs recovered from their lameness but did not thrive well, remaining culls till late in the season."

An experiment was also carried out by Hopkirk and Gill to illustrate infection through the navel. Each of a pair of twin lambs was inoculated, shortly after birth, into the tip of the navel string with a $\frac{1}{2}$ c.c. emulsion of the arthritis organism. One lamb showed slight lameness affecting a hind limb two days later. Ten days later both lambs were markedly stiff in their movements, and, although getting plenty of milk, were not thriving. This continued, the lambs moving painfully about with the ewe, feeding well but remaining stunted. At three months old the lambs were killed, and post-mortem examination showed the characteristic joint lesions from which the specific organism was recovered.

OUTBREAK ON FARM

The following details of an outbreak encountered on a farm is of interest: " The lambs had been marked in a pen beside the horse stables, and as each lamb was dealt with it was dropped over the fence into the stableyard, where it lay for a few moments in the dusty and soiled litter before wandering on through the yard and back to the pasture. When seen some eight days after the marking of 200 lambs about 20 per cent were affected in various degrees. The marking wounds had healed cleanly. No treatment was undertaken, and in three weeks all except about 5 per cent. were again sound. The following year the same farmer marked his lambs in a new yard and placed them straight from this into a clean grass paddock. The result was that not a single case of lameness occurred amongst them."

Hadleigh Marsh, of Montana, United States of America, who has conducted a lot of work on this disease, carried out some experiments in 1933, designed to show the portal of entry of the germ. He showed clearly that inoculation of cultures of the organism into the navel of young lambs produced the disease. Further, it was shown that newly-born lambs kept in pens on bedding which had been sprinkled with cultures of the organism developed the disease. This clearly demonstrated that in very young lambs the channel of infection is through the umbilicus. In the same way exposure of the docking and castration wounds to infected bedding resulted in the lambs so treated developing arthritis.

Having discussed the manner in which lambs become infected, we now come to the most important consideration—namely, prevention of the disease. Curative measures are useless, but prevention is possible if certain precautions are observed at marking-time. On farms where the disease is known to occur docking should be carried out on a fresh site, the yards previously used for this purpose being avoided. All instruments should be sterilized by boiling before use, and frequently immersed in antiseptic solution during the operations. (A 2-per-cent. solution of Lysol, Jeyes' fluid, &c., can be employed.) In selecting the site for temporary yards for marking, a well-grassed area should be chosen. After marking the lambs on a rail of the outer fence, care should be taken to place them on their feet and allow them to run away on a clean grass paddock.

USE OF ANTISEPTICS.

Regarding the use of antiseptics: Too irritant solutions must not be employed. A 1-per-cent solution (about 1½ oz to the gallon of water) of any of the standard disinfectants (Lysol, Jeyes' fluid, &c.) will be sufficient. It is desirable to apply the solution to the skin of the purse and tail before castrating and docking are actually performed, as well as after. The use of a syringe by which the solution could be quickly "jetted" on to the parts by an assistant standing alongside the operator is worthy of consideration. Cleansing of the operator's hands and overalls must not be neglected.

Reference has been made to that form of arthritis which occurs before marking and in which the channel of infection is supposed to be through the navel. Preventive measures here will include antiseptic dressing of the navel string of newly-born lambs; for this purpose tincture of iodine is employed. This form of arthritis is, however, relatively uncommon. It is questionable whether the preventive measures are practicable in large flocks at lambing-time.

The use of the emasculator or bloodless castrating instrument (one make of which is known as the "Daroux") gives satisfactory results when properly employed might be considered on farms on which arthritis in lambs is common. By its use one avenue of infection, the castration wound, is eliminated. With regard to docking, it is held that the use of the red iron is generally followed by less trouble, and it is probable that rapid searing of the tail after severance with the knife would prove useful in the prevention of infection.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal*, include the following of agricultural interest —

No 77903 Seed-mixing attachment: A R Craddock. No 77908: Milking-machine, R J Simpson. No 77915: Wire-strainer, M S. Chalmers. No 77934: Flax-treatment: Oonah Ltd. No 77957. Milk-cooler, E Hoyland. No 77959: Plow-coulter clamp; A S Shepherd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

The Fields Instructor, Masterton, records that a farmer in the Akitio district has successfully established subterranean clover by broadcasting on rolling country without any form of cultivation. Two autumns ago 3 lb. of subterranean clover seed per acre was sown broadcast on a 200-acre paddock.

PASTURE TOP-DRESSING IN THE AUCKLAND PROVINCE.

EXPERIMENTAL WORK BY THE FIELDS DIVISION, PERIOD 1928-36

P. W. SMALLFIELD, Fields Superintendent, Department of Agriculture, Hamilton

DURING the twelve months ended 31st January, 1936, over 1,500,000 acres of grassland were top-dressed in the North and South Auckland Land Districts as follows :—

	North Auckland Acres.	South Auckland. Acres	Total Acres.
Fertilizers only ..	289,915	614,277	904,192
Lime only	20,018	24,751	44,769
Fertilizers and lime ..	162,433	421,082	583,515
	472,366	1,060,110	1,532,476

Phosphates, chiefly superphosphate, formed almost the entire bulk of the fertilizers applied, and only about one-third of the land received lime in addition to phosphates. In the last review(1) of Auckland top-dressing trials the conclusions reached were : " The results of the top-dressing trials . . confirm general farm practice. Superphosphate is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime. Rock phosphates are generally inferior to superphosphate or slag. Potash responses are not frequent, and, when responses are secured, they are generally slight." During the past two years experimental work has greatly extended our knowledge regarding the use of potash and lime. Bell(2) has described areas where very definite and payable potash responses are obtained ; and in other districts some slight potash responses have been recorded. Our knowledge regarding the use of lime has also increased, particularly through the work of the Soil Survey Division of the Department of Scientific and Industrial Research, enabling lime responses to be more definitely correlated with soil type.

THE USE OF LIME.

" Can nobody give us an answer—the truth and the whole truth of the operation of lime upon soils ? "(3). So the question was framed eighty years ago, and now, although the whole truth still eludes us, the action of lime in improving soil fertility is better understood : it frequently plays a controlling part in soil fertility, preventing or correcting the conditions of " acidity " or " lack of basicity " (commonly called " sourness ") that are unfavourable to many cultivated plants. Acidity in a soil commonly occurs in wet climates and is caused by the washing-

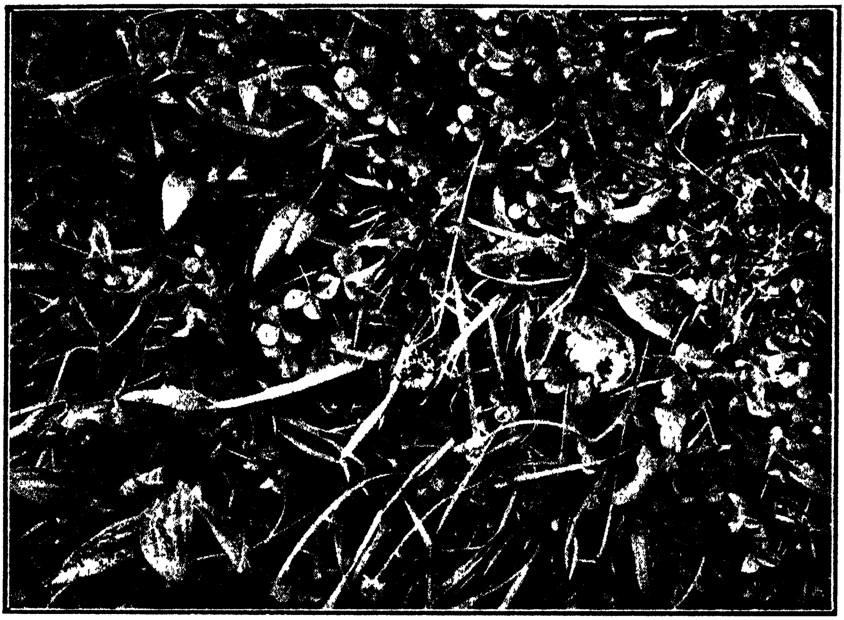

FIG. 1.

Experiment 16/1/432. Superphosphate plot on red-brown soil; two autumn dressings of 3 cwt. of super; response fair; sward consists of a little rye-grass, white and subterranean clovers, brown-top, and plantain making poor growth.

FIG. 2.

Experiment 16/1/432: Slag plot on red-brown soil; two autumn dressings of 3 cwt. basic slag; response good; dominant subterranean and white clovers with a little rye-grass and plantain making good growth.   [*Photos, H. Drake.*

out of the bases from the original soil by percolating water. In acid soils soluble iron, aluminium, and manganese compounds are frequently present in sufficient quantities to injure plants, but so long as the soil reaction remains about neutrality the compounds of these metals present in the soil are practically insoluble and do not affect plant growth. This does not apply to red-brown-soil group, which may require lime although the soil is near neutrality. Although it is impossible to ascertain the amount of lime necessary for a soil except by actual field trials, the appearance of the soil profile—*i.e.*, the measure of soil leaching—is a fair guide as to whether a soil will or will not respond to lime. Young soils are not responsive to lime, leached soils are acid, frequently contain toxic amounts of soluble iron and aluminium compounds, and respond to lime. This broad outlook on liming fits in quite well with the lime responses obtained in the Auckland Province. The young soils (volcanic ash showers) of the Bay of Plenty and Central Plateau do not respond to lime, the slightly podsolized soils of the Waikato give a slight response, and the mature podsols and red-brown soils of South and North Auckland show marked lime responses. The locality responses to lime and fertilizers are given in Tables I to V. In the Bay of Plenty super alone generally gave a good response, and in only three out of twenty-two trials did the addition of lime cause definite improvement. In the Central Plateau area super alone was consistently good, and only in one trial out of ten

FIG. 3.

Experiment 16/1/432. Slag plus lime plot on red-brown soil; two autumn dressings of 3 cwt. of slag, one ton of lime at laying down and one autumn dressing of 5 cwt.; response very good; good sward of clovers and grass making a strong growth. [Photo, H. Drake.

did lime give an appreciable improvement ; the effect of lime was often detrimental. Most of the trials in the Waikato were placed on land that had previously been top-dressed with phosphates for many years, and the relative response to phosphates and lime is not as marked as in other districts where top-dressing is a newer practice. As in the Waikato, the experiments in South Auckland were laid down on land previously top-dressed, and the response to superphosphate was relatively slight, particularly in the first year ; on the clays and some of the red-brown soils lime and super has given better results than super alone. In North Auckland super and lime have given definitely better results than super alone.

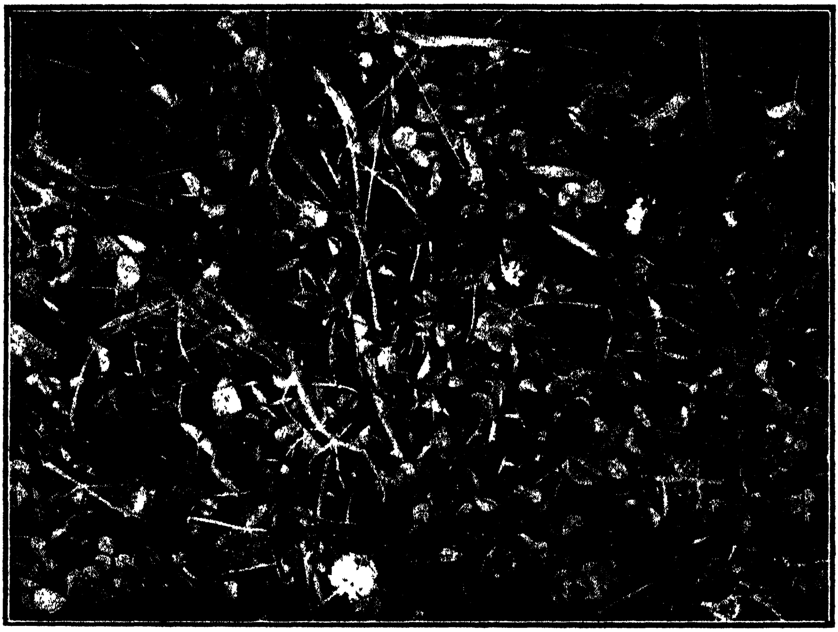

FIG. 4

Experiment 16/1/432 Super plus lime plot on red-brown soil ; two autumn dressings of 3 cwt. of super, one ton of lime at laying down and one autumn dressing of 5 cwt. ; response good ; good sward of clovers and grass growing vigorously.

[*Photo, H. Drake.*

POTASH AND PHOSPHATE RESPONSES.

Except for the Waihi District(2) and some peat soils of the Waikato, potash responses are not very marked in Auckland. Trials laid down on sandy peat in North and South Auckland, although few in number, indicate that potash is a necessary fertilizer on this soil type. In the Waikato lime, super, and potash have given slightly better results than super and lime, and alternate mowing and grazing trials have now been established at Ruakura Farm of Instruction, Hamilton, to measure the lime, potash, and phosphate responses on the Hamilton clay loam, Horotiu sandy loam, and Te Kowhai loam soil types.

As has been quoted above, in the last summary of top-dressing experiments in Auckland the statement was made that " superphosphate is generally the cheapest and most efficient phosphate for pasture top-dressing, but on some soils lime is necessary to enable the best results to be obtained from superphosphate. Slag is also quite efficient, but is not superior to superphosphate or superphosphate and lime." Further trials of super and slag have been carried out in North and South Auckland (red-brown soils and gumland podsols), and the results are given in Table VI. On these soils slag alone is better than super alone, lime and super is generally better than slag alone, super and lime and slag and lime are about equal, although there is an indication that slag and lime may be slightly better than super and lime.

EXPERIMENTAL PLOTS.

The top-dressing plots were laid down in duplicate on farmers' fields and were kept under observation for periods of from two to four years. They were treated as follows: at laying down—(1) carbonate of lime, 1 ton per acre; (2) super or slag, 3 cwt. per acre; (3) 30 per cent. potash salts, 2 cwt. per acre. Annual top-dressing consisted of—(1) carbonate of lime, 5 cwt.; (2) super or slag, 3 cwt.; (3) 30 per cent. potash salts, 2 cwt. per acre. The arrangement of the plots was such as to give comparisons of each treatment and combinations of the above treatments with no manure. The method adopted to indicate the nature of the differences has been to award points based on visible responses as compared with no manure as follows: 0, no visible response; ?, doubtful response; 1, slight response; 2, fair response; 3, good response; 4, very good response; 5, excellent response; half points are also used—*e.g.*, 1½ = slight to fair.

Table I.—Responses to Fertilizers: Bay of Plenty.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash	Lime plus Super plus Potash.
16/1/120	Sandy loam ..	?	2	0	3	2	2
121	,, ..	0	3	?	3	3	3
124	,, ..	0	3	0	3	3	3
139	,, ..	0	3	0	3	3	3
140	,, ..	0	3	0	3	3	3
141	,, ..	0	3	?	3½	3½	4
162	,, ..	1	3	0	4	3	4
176	,, ..	2	3	0	4	3	4
201	,, ..	1	2	0	2	2	2
240	,, ..	½	2½	½	2½	2½	3
254	,, ..	0	2	0	2	2	2
255	,, ..	0	2½	0	3	3	3
256	,, ..	1	3½	½	4	4	4
257	,, ..	½	3	½	3½	3½	3½
258	,, ..	½	4	0	4	4	4½
261	,, ..	?	1½	?	2	2½	3½
274	,, ..	0	2½	?	2½	2½	3
275	,, ..	0	1½	0	1½	1½	1½
283	,, ..	½	2	?	2½	2½	2½
362	,, ..	0	3½	0	3½	3½	3½
288	Gravelly sand ..	0	2	0	2	2	2
276	Peat	?	½	?	2	1½	2

Table II.—Responses to Fertilizers. Central Plateau.

Trial.	Soil Type.	Responses to Fertilizers (0, no response, ?, doubtful; 1, slight, 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash	Lime plus Super.	Super plus Potash	Lime plus Super plus Potash.
16/1/156	Sandy loam ..	1	4	1	3½	3½	3½
188	,, ..	1	2½	½	3	3	3½
189	,, ..	−1	3½	1½	3½	4	4
190	,, ..	?	3	1	3½	3	3½
191	,, ..	−2	3	0	3½	3	3
203	,, ..	−1	2	1	3	4	3½
206	,, ..	1	3	1	3	3½	3
207	,, ..	− ½	3	½	3	3	3
209	,, ..	1	3	½	3	3½	3½
210	,, ..	1	2½	?	2½	3	2½

Table III.—Responses to Fertilizers: Waikato.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good, 4, very good; 5, excellent response.)					
		Lime.	Super	Potash.	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/243	Hamilton clay loam	1	2	1	2	3	3½
251	,,	1	3	1	3½	3½	4
252	,,	½	1	½	1	1	1
422	,,	½	2½	½	2½	3	3
423	,,	1	2	1	2½	2½	3
239	Horotiu sandy loam	½	1½	1½	2	3	3
342	,,	½	1½	2	2	3	4
346	,,	½	2½	½	2½	3	3
374	,,	1	1½	½	2	2	2½
376	,,	½	1	1½	1½	2½	3
343	Whatawhata clay loam	½	2	½	2	2	2½
404	Ditto	1	2	½	2½	2½	
235	Te Kowhai loam ..	½	1	½	1½	1½	1½
236	,, ..	1	1½	½	2	2	2½
344	,, ..	½	1½	1	1½	2	2
375	Rotokauri clay loam	1½	2½	½	3	3½	3½
377	,,	1	1½	½	2	2½	2½
378	,,	1½	2½	1	3	3	3½
387	Ohaupo silt loam ..	1	2	2	2½	3	3
391	,,	1	2	½	2½	2½	3½
393	,,	1	1½	½	2	2	2
394	,,	1½	2	2	2½	2½	3
242	Peat	½	1½	1	2½	2½	3
352	,, ...	½	1½	2	2	3	3½
389	,, ...	½	1½	3½	1	4	4
390	,, ...	½	½	½	1	1	1
421	,, ...	1	1½	½	1½	2½	2½

Table IV.—Responses to Fertilizers: South Auckland.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash	Lime plus Super.	Super plus Potash.	Lime plus Super plus Potash.
16/1/263	Silt	0	3	0	3	3	2½
177	Red-brown soil ..	3	2	?	4	2	4
178	" ..	?	1	0	1	1	1
198	" ..	?	?	..	1	?	1
246	" ..	0	½	2	½	3	3
279	" ..	1½	2½	?	4	2½	4
282	" ..	1	2½	0	3	2	2
285	" ..	1½	1½	0	3	1½	2
311	" ..	..	½	2	1	2	3
313	" ..	..	1½	0	3	2	3
314	" ..	..	½	0	½	1	1
167	Clay	1	1	0	2	1	2
169	"	3	?	?	3	?	3
195	"	3	1	..	4	1	4
250	"	2	2	0	2½	1	4
318	"	..	3½	0	4½	4½	4½
245	Loam	½	1	1½	1½	2½	2½
249	"	?	3	—1	3	2	2
286	"	½	2	0	2	2	2
289	"	½	0	1½	1	2	3
247	Sand	0	1	1½	1	2	2½

Table V.—Responses to Fertilizers: North Auckland.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash	Lime plus Super plus Potash.
16/1/94	Silt	0	2	1	4	3	4
147	"	1	1½	?	2	3	5
181	"	1	2	1	3	2	4
297	"	1	2½	0	5	2½	4
298	"	1	2	0	3½	2	3½
317	"	1	1	2	2	2½	3
373	"	..	1½	0	2½	1	3½
384	"	..	2	½	3½	2	4½
160	Red-brown soil ..	2	2	0	4	3	4
180	" ..	1	2	?	3	3	4
184	" ..	2	2	?	3	1	3
266	" ..	..	2	0	2½	2	3½
267	" ..	..	1½	½	2½	2	3½
269	" ..	..	2	0	3	2	3
271	" ..	½	1½	½	2	2	2½
316	" ..	1	2½	1	4	2½	4½
383	" ..	..	½	0	2½	2	2½
385	" ..	..	2½	0	3	½	2½
427	" ..	..	½	0	2	½	2½
428	" ..	..	1½	0	2½	1½	3
431	" ..	..	1½	0	2½	2	3
432	" ..	..	2	0	3	2	4½

Table V—continued.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)					
		Lime.	Super.	Potash.	Lime plus Super.	Super plus Potash	Lime plus Super plus Potash.
16/1/492	Red-brown soil	..	1½	½	2½	1½	3
98	Clay	0	3	0	3	3	3
132	,, ...	1	2	1	3	3	3
183	,, ...	4	1	?	5	1	5
185	,, ...	2	1	1	3	3	3
260	,, ...	1½	3	0	5	2½	4½
265	,, ...	..	1½	0	2½	2	3
278	,, ...	..	2	0	3	1	3
280	,, ...	..	3½	3	4	3	4
290	,, ...	1	2	0	4	2½	4
293	,, ...	0	2	0	2½	2	2½
315	,, ...	1½	2	0	3	2	3
291	Loam	½	3	0	4	3	4
292	,, ...	½	2	0	2½	2	2½
294	,, ...	1	4	0	5	4½	5
295	,, ...	½	3	0	3½	2½	3
268	Sand	½	2½	0	3½	3	3½
281	,, ...	..	3	1	3½	3	4
270	Sandy peat ..	½	4	?	4	4	4½
284	,, ..	..	2	1	3	4	4½

Table VI.—Responses to Fertilizers: North and South Auckland.

Trial.	Soil Type.	Responses to Fertilizers. (0, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent response.)						
		Slag.	Super.	Lime plus Super.	Lime plus Slag.	Lime plus Super plus Potash.	Lime plus Slag plus Potash.	Potash.
16/1/373	Silt	2½	1½	2½	3½	3½	4½	0
384	,, ...	3½	2	3½	3½	4½	5	½
266	Red-brown soil ..	2½	2	2½	2½	3½	3½	0
267	,, ..	3	1½	2½	3	3½	4	½
269	,, ..	2	2	3	3	3	3½	0
311	,, ..	0	½	1	0	3	1½	2
313	,, ..	2	1½	3	3	3	3	?
314	,, ..	0	½	½	0	5	5	1
383	,, ..	2	½	2½	2½	2½	3½	0
385	,, ..	2½	2½	3	3	2½	4½	½
427	,, ..	2½	½	2	3	2½	3½	0
428	,, ..	2	1½	2½	3	3	3½	0
431	,, ..	2	1½	2½	2½	3	3	0
432	,, ..	3	2	3	4	4½	4½	0
492	,, ..	2½	1½	2½	3	3	3½	½
265	Clay	2½	1½	2½	3	3	3½	0
278	,, ...	2½	2	3	3	3	3	0
280	,, ...	4	3½	4	4½	4	4½	0
318	,, ...	4	4	4½	4	4½	4½	0
284	Sandy peat ..	2½	2	3	3	5	5	1

ACKNOWLEDGMENTS.

The field-work of these experiments was carried out by Instructors in Agriculture E. B. Glanville, E. H. Arnold, J. E. Bell, C. Walker, and Fields Instructors R. P. Hill, J. F. Shepherd, C. S. Dalgliesh, and K. M. Montgomery; they supplied the writer with the information on which this description of top-dressing experiments has been prepared. The writer also wishes to acknowledge assistance received from Crop Experimentalist J. W. Woodcock in the preparation of this report. Thanks are due to the numerous farmers who placed fields at the disposal of the Department of Agriculture for the experiments.

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(3) CHANDOS WREN HOSKYN'S "Chronicles of a Clay Farm," 1857.

SCIENTIFIC TESTING OF DAIRY-PRODUCE FOR EXPORT.*

A BRIEF HISTORICAL REVIEW.

G. M. MOIR, Dairy Laboratory, Wallaceville.

ABOUT half a century ago, when our dairy industry was in its infancy, the difficulties which beset the pioneers were immense by comparison with those of the present day. In order to overcome the obvious lack of knowledge which prevailed, the Government of the day recognized the necessity for a dairy instructional service as part of State assistance toward the development of agriculture. Every effort was made to obtain men of experience for this work, but owing to the lack of knowledge, both scientific and practical, the early officers were often thrown upon their own resources in trying to discover the most suitable procedures. To-day a large amount of experience is available to indicate, for example, the most suitable temperatures for various manufacturing operations and storage conditions. Much of this experience is based upon the methods of trial and error which the early instructors were forced to adopt, often without the facilities either for precise control provided by modern refrigeration or of systematic procedure as applied in present-day scientific investigation. By the careful and persistent efforts of the instructors, in co-operation with factory-managers and farmers, many of the early problems were solved one by one. Thus the instructional, grading, and testing system has been gradually built up to function as smoothly and efficiently as it does to-day.

Contrary to the prevailing impression that only within the last few years have efforts been made to apply science to dairying in New

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* This article is the substance of a paper which was read at the Auckland meeting of the Australian and New Zealand Association for the Advancement of Science in January, 1937.

Zealand, it can truthfully be asserted that from the earliest times such scientific methods as were available were introduced. To support this statement many examples could be cited, but two outstanding ones are the Babcock test and the acidimeter. The Babcock test was introduced to New Zealand in 1892, only two years after it was devised in America by Dr. S. M. Babcock, while the acidimeter was introduced thirty-five years ago by Mr. W. M. Singleton, now Director of the Dairy Division. In his original bulletin he records that the test was devised in 1899 by the English cheddar-cheese expert, Professor F. J. Lloyd, and was first used abroad at the Kingston Dairy School, Ontario. In addition to sound practical experience before his arrival in New Zealand, Mr. Singleton, in his dairy-school training, had opportunities of becoming conversant with the most up-to-date scientific information then available. He was, in fact, one of a number of overseas experts such as Messrs. Ruddick, Kinsella, Petersen, Sorensen, and others who were brought to this country to assist in the early development of the dairy industry. Many examples, past and present, could be cited of men who have been anxious to have more scientific assistance. This thirst for knowledge, which from the beginning possessed the leaders of the dairy industry, shows that they recognized the value of applying science to practice. Their close contact with practical conditions enabled them also to realize the difficulties which stood, and to-day still stand, in the way of attaining this ideal.

Early Scientific Work.

Early reports of the Department of Agriculture show that the Dairy Division frequently had the assistance of the Department's scientific staff, particularly Dr. J. A. Gilruth for bacteriological work, and Mr. B. C. Aston for chemical work. For example, standard alkali was supplied free of charge to factories from the Department's chemical laboratory to encourage the introduction of the acidimeter. In later years a considerable amount of work was undertaken for the Division by this laboratory, whose chemists supervised much of the early testing-work in the grading stores. In this connection mention should be made especially of the services rendered by the late Mr. F. T. Leighton, who took a great interest in dairy-work. The time of these officers was, however, often taken up with other duties, so that the Dairy Division did not get nearly as much scientific assistance as it required. This is made clear by the following quotation from the annual report of the Dairy Commissioner, Mr. J. A. Kinsella, in 1901 : " No proper departmental facilities exist for carrying out such investigations on scientific lines." It was not until 1928 that Mr. G. F. V. Morgan was appointed to the Dairy Division to undertake bacteriological testing of faulty produce. In spite of the fact that the Dairy Division is still to-day, as it was in Mr. Kinsella's time, lacking in scientific assistance, appreciable progress has been made, and many useful investigations have from time to time been carried out and recorded on the departmental files without further publication. Failures have been forgotten, and successful methods applied to daily practice.

Referring again to the acidimeter for the titration of whey during cheesemaking and of cream in buttermaking, its value to the industry can scarcely be assessed. Simple as the test appears, it is not without pitfalls. One of the commonest mistakes which was pointed out in Mr. Singleton's original publication is that of titrating to too deep a shade of pink. Notwithstanding the constant efforts of the Dairy Instructors this fault still occurs, especially in butter-factories, as Mr. G. M. Valentine's bulletin points out, but a method of checking this is now available, and is described later.

For a time after the introduction of the fat test, the accuracy of all the glassware used for milk and cream testing in the factories was checked in the Department's chemical laboratory. For some years this has been checked in the grading stores. In the early development of the test-room work a great deal had to be done with very primitive facilities. To-day many improvements have been introduced and better equipment provided in the testing-rooms. In Auckland, where very large amounts of butter are dealt with, facilities are being provided for the introduction of various special tests which will be referred to later.

Cheese Investigations.

Some very useful information can be obtained about cheese by ascertaining its content of fat, moisture, and solids-not-fat. The first work of this kind was initiated about twenty-five years ago under the supervision of Mr. W. E. Gwillim. Several accounts of the early results were published by him in the *N.Z. Journal of Agriculture*, 1913, Vols. VI and VII, from the former of which the following quotation is taken :—

" The main objects of the examinations were to try to ascertain (1) to what extent the principal constituents of the cheese varied in the makes of the different factories, (2) whether the fat content was in conformity with the legal standard, (3) and whether knowledge of the chief component parts of the cheese would have any useful influence in assisting the grader to a better understanding of the merits or otherwise of the body and texture at the time of grading. . . . The content of moisture was ascertained by drying in a steam-jacketed oven, and the fat content by the Babcock method. Exception may be taken to these methods, but there are good grounds for believing that the results obtained are good and accurate enough for all practical purposes."

Systematic testing of cheese for moisture and fat content came into prominence during the period in 1929–31 when standardized cheese was made, and control was necessary to ensure that no cheese with less than 50 per cent. of fat in the total solids was exported. Although standardizing was stopped a certain amount of this work has been continued, chiefly for the purpose of checking factories which have unjustifiably high yields. At Wallaceville a simple grating machine for shredding the cheese has been found very convenient for obtaining a homogeneous sample. Such graters are now regularly used in all testing-rooms. By using also a suitable sampling tube to take portions of equal size from different plugs it is possible to prepare composite samples from several vats of cheese and thereby reduce the number of tests required. Cheese thus grated is in a very suitable form for drying, and also for fat tests by the Babcock method. Since the introduction of this system, samples of every vat of cheese at all the principal grading stores are taken and included in the Babcock test for fat. As the latter method has long been considered to give slightly lower figures, the use of a little normal butyl alcohol was suggested in order to improve the results. Tests carried out in the Auckland grading store by Mr. A. G. Frieberg have shown that ¼ ml. of this alcohol per test gives improved accuracy when the results are compared with those obtained by the Werner-Schmidt method.

For salt tests upon cheese Dr. F. H. McDowall's method has been modified to enable it to be used in the grading stores, where it is occasionally applied. A few years ago many samples of cheese were examined at Wallaceville to see whether a pH test could be used to select cheese with too little or too much acid. Eventually the conclusion was reached that the grader's judgment of the colour was very reliable and much quicker. The same may be said of certain other chemical tests which may be useful to confirm the grader's judgment in special cases.

During the early stages of the establishment of the casein industry attention was given to various tests which might be suitable for assessing the quality of the casein. Eventually a borax solubility and pH colour test was devised by Mr. W. R. Mummery of the New Zealand Casein Co., who used it, in collaboration with Mr. J. W. Smith of the Division's Instructional staff, to indicate whether the casein had been properly treated in the factory. The regular use of this test in the grading stores enabled the stage to be reached when only a very small proportion of the samples failed to attain the standards specified in the method.

Moisture in Butter.

In the testing of butter consideration was early given to its moisture content. Thirty years ago a great deal of the butter exported had a water content several per cent. below that permitted (16 per cent.). When factories attempted to increase the water content, churnings were sometimes made with too much water. Systematic testing was required to check this, and eventually it was found necessary to test every churning. To-day an immense amount of work is involved in testing 186,000 samples annually, but this ensures that no butter is exported with excess moisture. Not very long ago serious complaints were made in London about the large quantities of overmoist butter arriving from a certain country, where the testing is not as thorough as in New Zealand. Systematic testing has for many years safeguarded our reputation in this respect. Overmoist butter is returned to the factory to be reworked, and is again tested before it can be exported.

Many years ago the salt content of butter was determined by dissolving the fat in acetone and titrating with silver nitrate. This was superseded by the method devised by Sammis, which, it may be mentioned, was recommended by Mr. W. E. Gwillim in 1913, and is still regularly used. It consists of the titration of an aliquot with silver nitrate and chromate, so that the burette reading gives the salt percentage. The method is rapid and reasonably accurate for practical purposes, and if necessary can be made more accurate by a simple modification. We have recently endeavoured to perfect an electrical method which is even quicker than the titration method. With adequate temperature control this gives very good results, but some difficulty has been experienced in maintaining the electrodes free from interference with fat and casein particles.

At one time certain overseas markets allowed boric acid preservative in butter while others did not. The latter required a certificate of freedom from boric acid, and for this purpose the test with turmeric paper was applied to the serum of the butter in question. Testing is no longer necessary, as the use of boric acid has been discontinued since it was prohibited by British regulations in 1928.

In addition to the tests needed to satisfy the requirements of those to whom we export our butter, administrative considerations have necessitated the analysis of regular samples for fat and curd content. In this way a check can be kept upon certain creameries which have been found to export in their butter more butterfat than they purchase from their suppliers. For these tests the Kohman method is used, whereby, after heating to dry off the moisture, the melted fat is dissolved in petrol and decanted after allowing the curd to settle. The idea of using one of the new non-inflammable solvents for this purpose proved impracticable, owing to its high specific gravity, which prevented a satisfactory separation of the curd particles. The risk of fire can be reduced by using a high-boiling petroleum spirit which does not contain the more volatile fractions present in ordinary petrol.

Deterioration of Butter.

In New Zealand dairy practice it has long been realized that acid butters were liable to deteriorate seriously when stored. Reduction of the acidity of the cream with bicarbonate of soda avoided this. The use of excess of soda gave butter of quite remarkable keeping quality but at the sacrifice of flavour, which, if not actually recognized as alkaline, was often complained of as flat and neutral. Thus arose the desirability of a simple and rapid test to indicate the alkalinity of butter. The first work of this kind was done in 1932 in the Division's test-room at Castlecliff, Wanganui. There Mr. F. Bishop applied to butter the brom-thymol-blue indicator method used for casein-testing. Officers of the Dairy Division later drew Dr. McDowall's attention to this procedure, and he made a series of experiments using both brom-thymol-blue and phenol-red. In such tests the principal difficulty is that the butter serum, to which the indicator is added, is a milky liquid, while the standards are clear. At Wallaceville a means was eventually devised of preparing standards which are of a somewhat milky nature similar to the butter serum with indicator. These have now been in use for some time at several of the grading stores. The colour tests are very valuable for sorting purposes to enable the selection of butters which are too acid or too alkaline, and these are now frequently retested in Auckland by the more accurate electrical method. When due allowance is made for the difficulties, the agreement obtained is quite satisfactory. These tests provide the graders with a means of confirming their opinions about butters which are too acid due to the excessive use of starter, or too alkaline due to the excessive use of neutralizer. Thus careless use of the acidimeter in butter-factories can be checked.

For many years it has been realized that contamination of butter with iron or copper was a cause of serious defects. On occasions an experienced grader has been able to say that a certain butter owed its defective flavour to copper contamination, this being confirmed by a visit to the factory. Notwithstanding the skill of the graders, such a method has its limitations. Except for the work of Mr. W. Williams of the New Zealand Co-operative Dairy Company's Laboratory, very little has been done by way of systematic testing of our butter for metals. In the past this has been due partly to lack of staff and partly to the difficulties of the methods available. The wet or dry ashing of butter is not an easy process, especially when the metals sought are present to the extent of only one or two parts per million, or even less in the case of copper.

Consideration has for some time been given to the possibility of developing a filtration method which would eliminate the necessity for ashing. Until the assistance of Mr. E. D. Andrews was available, insufficient time could be devoted to overcoming the many difficulties. After much careful work a suitable method has been evolved, whereby very satisfactory results can be obtained in estimating the iron content of 10-gram samples of butter, the operations being completely carried out in small centrifuge tubes and test-tubes. This method is now in use in the grading store in Auckland. By using larger centrifuge tubes we have the advantage of dealing with 25-gram samples. A similar method has also been evolved for the estimation of the copper content, for which 25-gram samples are essential. As a rule these filtration methods give better agreement of duplicates than the ashing procedure. The results so far obtained show that very few creamery butters approach the danger point in iron content. This is a tribute to the activities of factory-managers and Instructors in checking the use of rusty cream-cans. Regarding copper content, the position is not quite so satisfactory, but regular testing should enable the Instructors to track down badly tinned equipment.

Flavour Problem.

In one or two cases complaints of metallic flavour in butter have been investigated and evidence obtained that the trouble was of bacterial origin, due probably to the presence of lipolytic or fat-splitting bacteria. Thus we come to the question of the bacterial content of export butter. Although it has not so far proved possible to arrange for bacterial examinations to be done in the grading stores, samples are now regularly taken in sterile fashion in both Auckland and Wellington and forwarded to the laboratory at Wallaceville. Space does not permit of a detailed account of this work. With the assistance of Mr. R. R. Russell, simplified methods have been devised to ascertain the total count, the yeast and mould count, the count of fat-splitting germs, and the coliform content. Using these improved methods we have examined over a thousand samples of butter during the past year. The results obtained are now being regularly forwarded to the Division's Instructors to enable them to draw the attention of factory-managers to cases where the bacterial condition of their butter (and therefore of their equipment) is not what it ought to be, even though the butter may be grading well. Among other things these tests show that very few butters indeed actually contain moulds. Even surface samples rarely show mould infection. This trouble is apparently due to mouldy box timber from which the infection spreads under bad storage conditions.

This review indicates briefly the progress that has been made in the past and makes clear that there is still a great deal to be done. So long as we export dairy-produce faults will arise, and there must be increasing use of scientific tests to track these down so that our reputation for high quality can be maintained. It is unlikely that any of these tests can be used to grade the produce, but they are best applied to discover the reasons for faults which the graders detect, or which may develop after storage. Especially in regard to butter, the new testing methods described are in advance of those hitherto used either in New Zealand or in any other country.

THE TOMATO MITE (*Phyllocoptes* sp.).

W. COTTIER and G. G. TAYLOR, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

DURING October, 1936, tomato-growers in the Auckland District reported the occurrence of a disease on glasshouse tomato-plants, the cause of which was unknown. Examination of diseased plants revealed the presence of numerous small mites, specimens of which were sent to the Imperial Bureau of Entomology, London, and were identified by Dr. A. M. Massee as *Phyllocoptes lycopersici* Tryon.

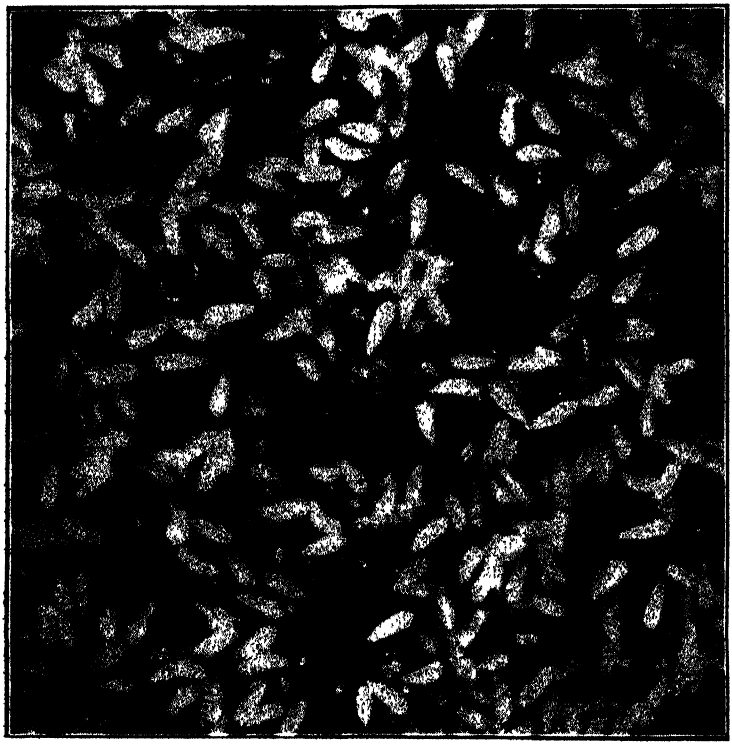

FIG. 1. MITES ON THE SURFACE OF A TOMATO-FRUIT.

Note the spherical shining eggs scattered through the colony. × 66.

Dr. Massee pointed out that the mite was first recorded by Tryon (1917) as a pest of tomatoes in Queensland, Australia, and that although it was named no specific description was supplied. Therefore the name used is invalid and the mite is here referred to as *Phyllocoptes* sp.

APPEARANCE OF THE MITE AND SYMPTOMS OF ATTACK.

The mites are small and can be seen clearly only under magnification (Fig. 1). They are elongated in shape and move by means of four legs placed at the head end of the body. The colour is cream in the adult form, and somewhat lighter in shade in the nymph stages. The mites aggregate on the surface of the plants in large numbers, and to the naked eye have the appearance of fawn-coloured dust. The eggs are about one-quarter the size of the adults. They are round, smooth, white, and shining, and are deposited abundantly on the surface of the infested areas.

Infestation may occur at any stage of growth, but the presence of the mites usually is not apparent until the plants are well established. The powdery masses of mites are first apparent on the lower part of the main stems and on the adjacent leaf-stalks. Later the colonies migrate in an upward direction on to the leaves, stems of fruit bunches, and finally on to the fruit. As the mites spread and grow in numbers the stem develops a smooth, bronze-coloured appearance, due to injury to the epidermis and to destruction of the epidermal hairs.

The plants become stunted and pallid, whilst the more severely attacked leaves wither and die. Plants which are young at the time of infection usually become severely damaged and eventually die ; on older plants spread of the mites may not be so extensive, but loss of crop usually occurs from reduced yield and damage to the fruit. Where the fruit is attacked a rough brown russet develops in the skin, accompanied by small cracks parallel to the circumference of the fruit, resulting in a characteristic " ringed " appearance.

INCIDENCE OF THE DISEASE AND ECONOMIC IMPORTANCE.

Morgan (1935) states that the first authentic record of the mite in New South Wales, Australia, was in 1929, although he considers it probable that the mite was there for several years prior to this. In that State the mite has been found on both glasshouse and outdoor tomato-plants.

In New Zealand during the summer of 1936-37 a survey was made of the glasshouse tomato crops grown in the vicinity of Auckland. Most of the crops were found to be clean, but isolated cases of attack occurred in the Avondale, Blockhouse Bay, Otahuhu, and Birkdale districts. The degree of infestation varied on different properties; in some instances only a few plants were attacked, while in the most severe case four houses were involved, in one of which over 50 per cent. of the plants were heavily infested. Several growers reported previous experience of the disease. From the evidence obtained it would appear that the pest first occurred in severe form in the autumn crops of 1935, although the cause of the disease at that time was not recognized. The pest has not been reported from any of the tomato-growing centres other than Auckland, where it has appeared only on glasshouse crops of tomatoes.

LIFE-HISTORY, OVER-WINTERING, AND SPREAD.

The life-history of the pest has not been fully investigated. That the mites pass through their life-cycle rapidly is indicated by the observed fact that a small initial infestation may become acute within a few weeks.

Carry-over from one crop to another occurs most readily in those houses where two crops are grown in rapid succession each year. In certain cases, however, houses have been replanted within three weeks of the removal of an infested crop without any subsequent attack by the pest. That the mites can over-winter in an unheated house seems probable, since live mites were found in the spring on old plants of an abandoned crop which had been heavily infested in the previous autumn.

Spread to glasshouses in which the mite has not previously been present may occur on the hands, clothing, &c., of visitors from infested houses or by the introduction of seedlings from infested nurseries. Once established the mites spread rapidly to healthy plants, and since they are relatively inert it would appear that the principal agents of distribution are the hands and clothing of workmen when pruning, cultivating, &c.

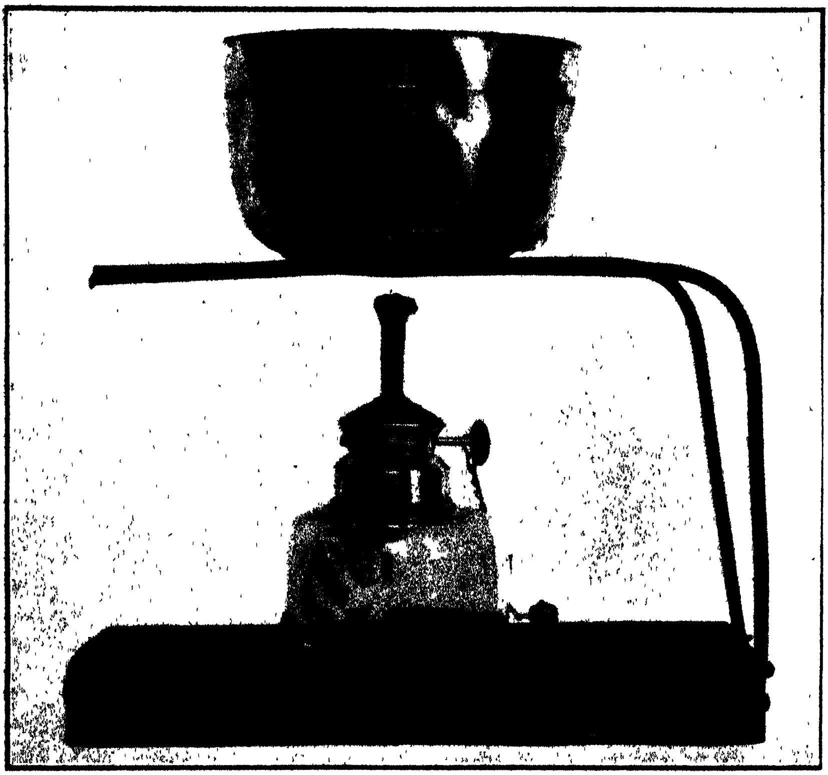

FIG. 2. SHOWING APPARATUS USED IN NICOTINE SULPHATE FUMIGATION.

The supporting stand consists of No. 8 fencing-wire bent into shape and stapled on a wooden base. [*Photo by H. Drake.*

RECOMMENDATIONS FOR CONTROL.

Fumigation and spraying tests were conducted for determining suitable methods of control. Of the methods investigated fumigation with nicotine sulphate gave the most efficient results. Several houses have been treated under practical conditions and complete control obtained in each case.

Nicotine sulphate should be used at a dosage of .25 c.c. (28·5 c.c. approximately equal 1 fluid ounce) to each 1,000 cubic feet of house.

The cubic capacity in feet of the usual type of house with centre ridge may be calculated by multiplying the length by breadth by average height: Average height equals

$$\frac{\text{(height from ground to ridge plus height of outer wall)}}{2}$$

Suitable apparatus for volatilizing the nicotine consists of small metal containers and methylated-spirit lamps (Fig. 2) To ensure that a lethal dosage of nicotine vapour is obtained throughout the house it is advisable to have one lamp and container to each 2,000 cubic feet and to adjust the flame of the lamp so that the nicotine is volatilized in about one hour. Since few houses are gastight it is advisable to choose a calm day for the fumigation and to commence treatment towards sundown, allowing the vapour to act overnight. In the morning the house should be thoroughly ventilated.

Where the house is insufficiently gastight to allow of successful fumigation, spraying with nicotine sulphate may be adopted. For this purpose nicotine sulphate 1 pint to 100 gallons water with 2 lb to 3 lb. soft soap should be used. Since it is almost impossible to obtain complete coverage, it is advisable to watch the plants closely for any subsequent spread of the mite and, if necessary, repeat the application.

Owing to the rapidity with which a small initial infection may become epidemic it is advisable to apply remedial treatment immediately the pest is observed.

In those cases where two tomato crops are grown each year the interval between the removal of an infested crop and the subsequent planting should be as long as possible. Care should be taken to remove all the old plants and, whilst the house is empty, to cultivate the soil thoroughly. As a precautionary measure fumigation or spraying is advisable as soon as the new crop is established.

ACKNOWLEDGMENTS.

The authors express their thanks to Mr. W. H. Rice, of Messrs. Radley and Co., Auckland, who first drew attention to the presence of the mite; to Mr. C. P. Gibson, of the Horticultural Division, for his assistance in carrying out the survey; and to Mrs. G. B. Pettie, of Avondale, who made available a number of plants for experimental spraying and fumigation.

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An outstanding result from superphosphate top-dressed at 2 cwt. per acre in November on tussock hill-country near Fairlie is recorded by the Instructor in Agriculture, Timaru An area of ½ acre, taking in both sunny and shady faces, was top-dressed and there has resulted a remarkable clover-growth, the clovers being red, white, and alsike. These clovers, save for a little stunted white, seem non-existent in the rest of the sward, which consists mainly of tussock, danthonia, catsear, brown-top, and haresfoot trefoil. No clover was sown with the superphosphate.

APPLICATION OF ORCHARD SPRAYS.

IV. SPRAY COVERAGE.

G. G. TAYLOR, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research.

THE significance of spray coverage as an essential factor in successful disease and pest control became apparent in New Zealand following surveys made in Nelson during the 1932–33 season and in Hawke's Bay in 1933–34. From the records obtained it was shown that wide differences occurred from one orchard to another in the volumes of spray applied per tree, and in the nozzle pressure maintained. Thus in different orchards where trees were of similar size the volume of spray applied per tree varied from ¾ gallon to 4 gallons and nozzle pressure from 100 lb. to 500 lb. per square inch. It was apparent, therefore, that either wide differences in disease-control were being obtained or in certain instances excessive amounts of spray were being applied. Similarly, differences in pressure indicated that these were unnecessarily high in some instances, or that, in others, the low pressure maintained resulted in inefficient disease-control.

The present series of experiments were undertaken to determine the significance of spray coverage in disease-control, and to ascertain the most efficient method of obtaining maximum coverage.

VOLUME APPLICATION.

To obtain maximum coverage it is necessary to apply more spray than is retained by the tree. Theoretically, wastage of spray could be reduced to a minimum by maintaining a low rate of delivery at the nozzles and by spending sufficient time in spraying. To be economical, however, spraying must be completed within a reasonable minimum time. With reduction in time of spraying a more than proportionate increase in volume delivery is required to assure that maximum coverage is obtained, with the result that a greater volume of spray is applied. The quantity retained by the tree, however, remains the same. Thus the volume application necessary to give maximum coverage is a variable factor dependent on the volume delivery of spray at the nozzles and on the time spent in spraying.

Experiments were carried out to determine (i) the significance of volume delivery and time of spraying on spray coverage, and (ii) the effects of variations in volume delivery on control of codling-moth, black-spot, and red-mite.

INCREASE IN TIME OF SPRAYING AND IN VOLUME APPLICATION.

EXPERIMENTAL METHOD.

The trees were selected by measurement, the average height being 8 ft. 3 in., and the average span of limbs 8 ft. 6 in. Volume delivery was kept constant at 1·375 gallons—*i.e.*, 222 fluid oz.—per minute, the treatment of the different plots being varied by increasing the time spent in spraying from 20 seconds per tree to 150 seconds per tree. Thus the minimum volume application was 73 fluid oz., and the maximum

550 fluid oz. A spray of 7·5 lb. hydrated lime* in 100 gallons of water was applied with a power spray-pump at a nozzle pressure of approximately 250 lb. per square inch.

Differences in coverage were ascertained by observation and by chemical estimation† of the weight of calcium hydroxide residue on samples of leaf tissue. Samples were obtained by cutting disks of tissue from the centres of leaves by means of a 1¼ in. hollow punch. Sixty disks were taken from each tree, thirty being from the outer parts of the tree, ten from the highest parts, and twenty from the inner portions. Leaves were picked in groups of eleven, and from these the disks were punched, the lowest being discarded to avoid possible loss of spray material or contamination from the board on which they had rested.

Preliminary tests indicated that samples of sixty leaf disks per tree gave sufficiently consistent results to show significant differences beween the various treatments.

RESULTS.

Where the lowest volume of spray (73 fluid oz.) was applied, in the shortest time (20 seconds) fine droplets of spray were deposited on portion of the fruit and foliage. Some of the leaves carried a continuous film of spray, and on certain of the apples the fine droplets of spray had coalesced to form larger drops. Considerable areas of the fruit and foliage were untouched by spray. As the time of spraying and therefore the volume application were increased, the areas completely covered with spary became more extensive, the parts with a cover of fine droplets less frequent, and fewer areas remained free of spray. Where 2 gallons (320 fluid oz.) were applied the trees appeared to be saturated with spray.

Chemical analysis showed that with increase in time of spraying and in volume application the quantity of spray residue on the samples of leaf tissue increased. The rate of increase in the quantity of spray residue recovered was rapid at first, became reduced as the higher volume applications were reached, and finally, after the trees were saturated with spray, constant amounts of spray residue were recovered irrespective of the quantity of spray applied (Fig. 1).

INCREASE IN VOLUME APPLICATION WITH CONSTANT TIME OF SPRAYING.

EXPERIMENTAL METHOD.

.Trees of approximately equal size were sprayed in five plots of four trees. The time of spraying was the same for each plot, but the volume delivery was varied by altering the diameter of the disk aperture in the nozzles so that volume application was increased. Each tree was sprayed for one minute, the minimum volume application per tree being 142 fluid oz., and the maximum 480 fluid oz.—*i.e.*, 3 gallons.

In addition to the estimation of spray residue on samples of leaves, the residue on fruit was measured. For the latter purpose sixty apples were taken at random from each plot, repeated tests having shown that this number gave sufficiently consistent results.

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* A high quality commercial product in which 88 per cent. of the particles were 10 microns and less.

† The majority of the analytical work recorded was carried out by the Dominion Laboratory, Department of Scientific and Industrial Research, Wellington.

In the experiment in which the spray residue on applies was measured hydrated lime was used at 6·3 lb. per 100 gallons of water. The average height of the trees was 8 ft. 6 in. and the average span of limbs 8 ft. 8 in. Where leaf-samples were taken lime was used at 7·5 lb. per 100 gallons of water, the average height of the trees was 7 ft. 4 in., and the average span of limbs 8 ft. 9 in.

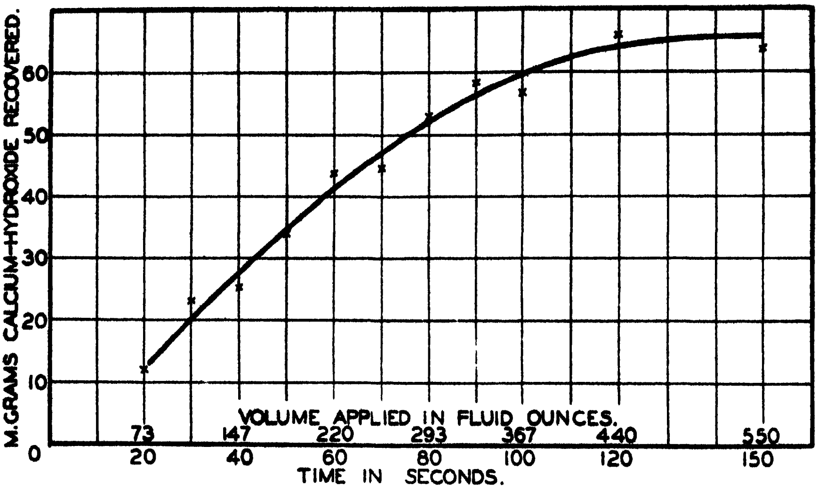

FIG. 1. EFFECT OF INCREASE IN TIME OF SPRAYING AND IN VOLUME APPLIED ON THE AMOUNT OF SPRAY RESIDUE ON LEAF-SAMPLES.

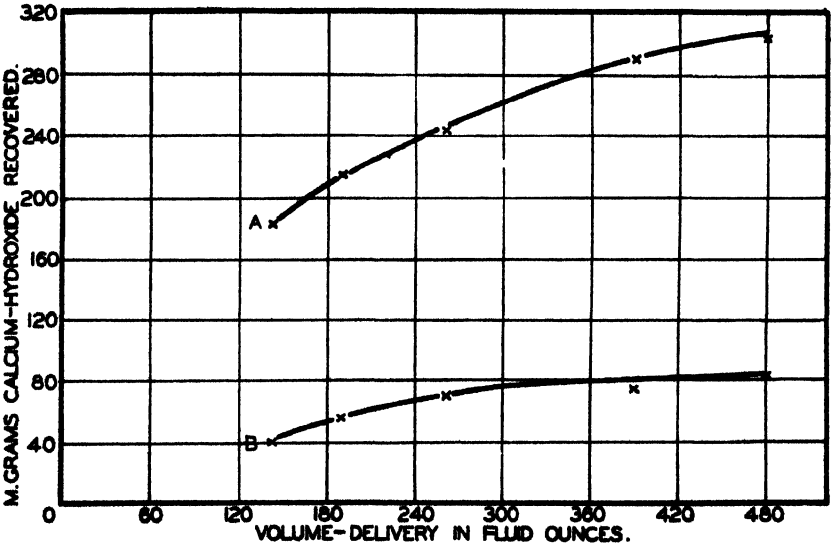

FIG. 2. EFFECT OF INCREASE IN VOLUME DELIVERY ON THE AMOUNT OF SPRAY RESIDUE ON (A) FRUIT-SAMPLES AND (B) LEAF-SAMPLES.

Other details of the experimental method were similar to those described above.

RESULTS.

Increase in volume delivery increased the amounts of spray residue remaining on the fruit and foliage (Fig. 2). Study of the plots indicated that the increase in spray residue was due mainly to the spray contacting with areas previously unsprayed, and, where the fruit was concerned, to the finer droplets of spray coalescing to form comparatively large droplets.

INCREASE IN TIME OF SPRAYING WITH CONSTANT VOLUME APPLICATION.

EXPERIMENTAL METHOD.

Methods similar to those described for the previous experiment were used. The time of spraying was varied for each plot. By adjusting the size of the disk aperture in the nozzles, volume delivery was varied inversely with the time of spraying so that each tree received the same volume of spray. The minimum spraying-time per tree was 30 seconds and the maximum 100 seconds, the volume application being 240 fluid oz. (1·5 gallon) in each case.

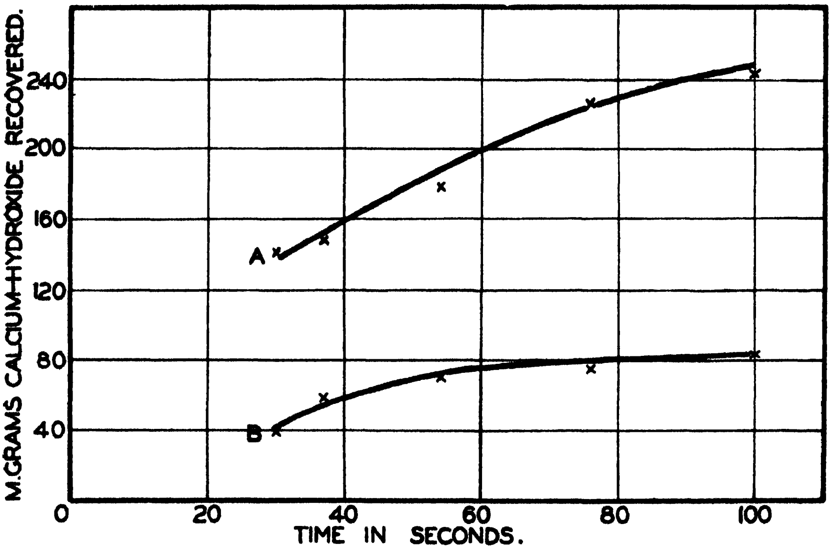

FIG. 3. EFFECT OF INCREASE IN THE TIME OF SPRAYING ON THE AMOUNT OF SPRAY RESIDUE ON (A) LEAF-SAMPLES AND (B) FRUIT-SAMPLES.

The hydrated lime was used at approximately 6 lb. per 100 gallons of water where leaf-samples were taken and at 6·25 lb. per 100 gallons of water in the experiment in which the residue on apples was estimated. In the former experiment the average height of the trees was 7 ft. 10 in. and the average span of limbs 8 ft. 11 in., while in the latter experiment these measurements were 9 ft. 3 in. and 9 ft. 9 in. respectively.

RESULTS.

As the time spent in spraying was increased, the amounts of spray residue recovered from samples of leaves and fruit increased (Fig. 3). Where spraying was rapid it was observed that certain areas were left unsprayed. With increase in spraying-time greater opportunity occurred for directing the spray over all parts of the tree, with the result that better coverage was obtained.

VARIATION IN VOLUME DELIVERY AS AFFECTING CODLING-MOTH CONTROL.

EXPERIMENTAL METHOD.

Forty large Ballarat trees, approximately 18 ft. in height were sprayed in ten plots of four trees per plot. The volume of spray applied to the trees of each plot was varied by adjustment of the volume delivered at the nozzles, the minimum volume being 0·8 gallons per minute, and the maximum 4·7 gallons. Nozzle pressure varied from 275 lb. to 300 lb. per square inch.

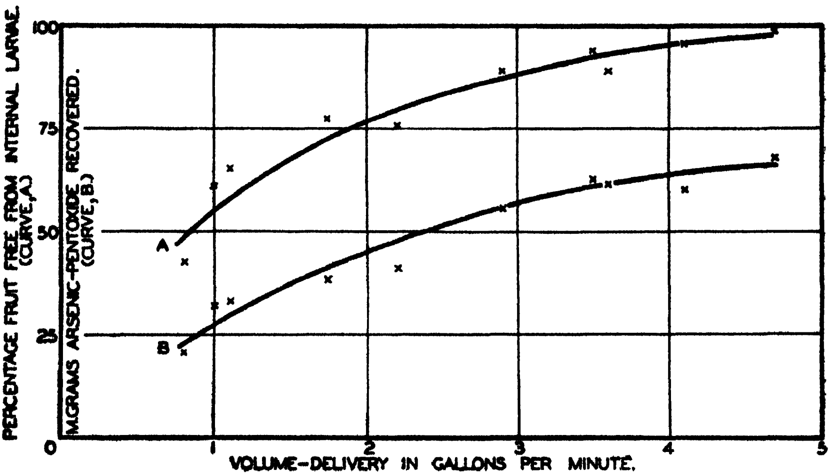

FIG. 4. EFFECT OF INCREASE IN VOLUME DELIVERY OF (A) CODLING-MOTH CONTROL AND (B) ON THE AMOUNT OF SPRAY RESIDUE ON LEAF-SAMPLES.

Owing to differences in tree size, a standard time for spraying each tree was not adopted. However, a constant speed of working was maintained so that the time spent in spraying varied directly with tree size.

Lead arsenate, 1½ lb. per 100 gallons of water, was applied at intervals of eighteen to twenty days from the 30th October to the 6th February.

Both windfalls and the picked crop were recorded, the fruit being divided into (i) clean or superficial damage only, and (ii) internal codling larvæ.

In order to correlate measurements of codling-grub damage with variations in spray residue, leaf-samples were taken as in the previous experiments, and the amounts of arsenate residue measured by chemical analysis.

RESULTS.

As volume delivery was increased from 0·8 gallons to 4·7 gallons per minute, increased control of codling-moth was obtained, the percentage of apples free from larvæ increasing from 43 to 99 (Fig. 4, curve A).

Chemical analysis showed that spray residue increased as volume delivery increased, with a close correlation between increase in spray residue and codling-moth control (Fig. 4, curve B).

VARIATIONS IN VOLUME DELIVERY AS AFFECTING BLACK-SPOT CONTROL.

EXPERIMENTAL METHOD.

Twenty medium-sized Sturmer trees, approximately 11 ft. in height and 12 ft. in span of limbs, were sprayed in five plots of four trees each. Volume delivery was varied from 1 to 3·5 gallons per minute. Similar speeds of working were maintained as in the previous experiment. The nozzle pressure varied from 250 to 300 lb. per square inch.

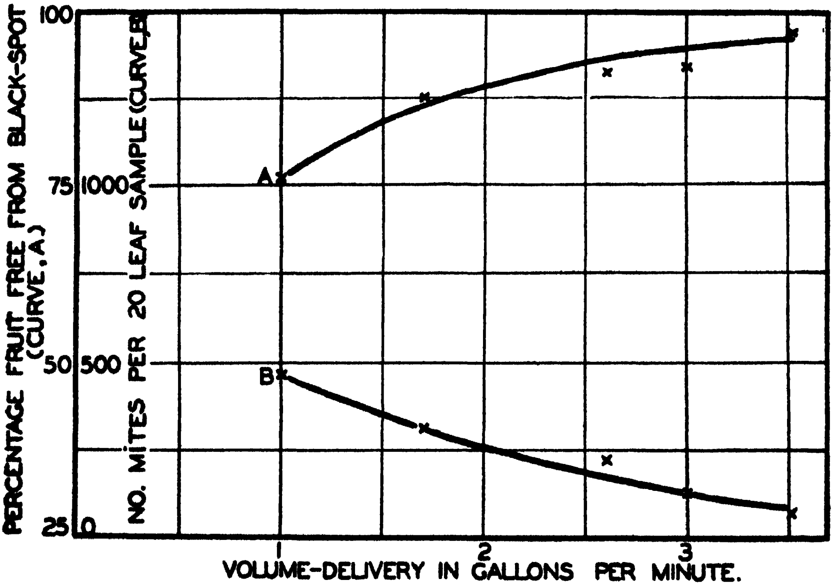

FIG. 5. EFFECT OF INCREASE IN VOLUME DELIVERY ON (A) BLACK-SPOT AND (B) RED-MITE CONTROL.

The spray-mixture consisted of lime-sulphur 0·1 per cent. polysulphide content and colloidal sulphur paste (50 per cent. sulphur by weight) 2 lb. per 100 gallons. The mixture was applied at eighteen- to twenty-day intervals from 2nd November to the 14th February, foundation sprays being the same for all plots.

Thinnings, windfalls, and picked crop were sorted into two groups consisting of (i) clean fruit and (ii) fruit showing one or more black-spot lesions.

RESULTS.

Increase in volume delivery from 1 to 3·5 gallons per minute resulted in increased black-spot control. Improvement in control was greatest as volume delivery was increased from 1 to 2·5 gallons per minute, and became less marked beyond this point (Fig. 5, curve A).

VARIATION IN VOLUME DELIVERY AS AFFECTING RED-MITE CONTROL.

EXPERIMENTAL METHOD.

The block of trees used was the same as that of the previous experiment, and the general procedure, including variations in volume delivery, identical. To determine approximately the degree of infestation, the numbers of mites on twenty leaves taken at random from each plot were counted before the oil-spray was applied. For the control of red-mite a summer-oil (approximately 85 per cent. oil) at 1 part in 100 parts of water was applied on the 19th January. Records of the numbers of mites remaining alive were taken on 23rd January. Differences between the various plots were determined by counting the number of mites on twenty leaves taken at random from each tree. Duplicate counts on individual trees showed that although the number of mites per twenty-leaf sample varied, the differences were insufficient to affect the significance of the results.

RESULTS.

Prior to the application of the oil-sprays the number of mites per twenty-leaf sample varied from approximately 4,000 where the volume delivery of the previous sprays had been lowest—*i.e.*, 1 gallon per minute—to approximately 2,000 where volume delivery had been highest—*i.e.*, 3·5 gallons per minute.

The numbers of mites on each twenty-leaf sample remaining alive after the application of oil-sprays varied from 460 where volume delivery was lowest to fifty where volume delivery was highest, showing that increased control was obtained as volume delivery was increased (Fig. 5, curve B).

DISCUSSION.

The experiments show that spray coverage and disease-control are markedly influenced by volume application. When considered in conjunction with the variations in volume delivery known to occur in orchard practice, it would appear that in many instances incomplete spray coverage is obtained. Field observations bear out this conclusion, for where successful disease-control is not obtained with the standard spray programmes* it is usually found that the volume application of spray is insufficient.

Variation in the two factors which determine volume application—time of spraying and volume delivery—both affect spray coverage. The time spent in spraying is a variable factor in practice, being influenced mainly by tree size and to a lesser extent by the standards set by different men when spraying. Efficient disease-control, however, is largely dependent on the rapidity with which a coverage of spray can be obtained over the whole orchard at critical seasons. For practical purposes the time spent in spraying may be therefore defined as the maximum working-speed. Under these conditions volume delivery becomes the significant factor determining volume application. These experiments indicate that for general orchard-spraying the optimum volume delivery is from 3 to 3·5 gallons per minute. For large trees a volume delivery of from 4 to 4·5 gallons per minute could be used with advantage.

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* See "Control of Orchard Diseases and Pests by Spraying," *N.Z. Dept. Agric. Bulletin 61.*

NOZZLE CONSTRUCTION AND NOZZLE PRESSURE.

The application of a sufficient quantity of spray is not alone sufficient to assure maximum coverage unless the construction of the nozzle and the nozzle pressure are such that the spray is distributed over a wide area. The significant factors in this respect have been discussed previously when dealing with spray nozzles. (See this *Journal*, Vol. 53, p. 68; Vol. 54, p. 71, p. 267).

Ideal coverage is obtained when the spray is deposited as fine droplets so close together as to leave a continuous cover of spray residue. It has been shown, however, that such a cover is impracticable, since the volume of spray required to saturate the trees is such that the droplets of spray coalesce and run-off occurs. The coverage secured after run-off has occurred varies from comparatively large isolated drops of spray to an almost complete cover of fine droplets, depending on the nature of the surface sprayed and on the conditions under which the spray is applied.*

Experiments were carried out to determine the significance (1) of variations in the conditions under which spray is applied, such as the fineness of the spray-droplets formed by the nozzles, depth of penetration, &c., and (2) of variation in the nature of the surface sprayed.

EXPERIMENTAL METHODS.

Apples of approximately equal size were removed from the trees and arranged in rows of nine with the stems uppermost. Each group was sprayed until considerable run-off occurred, and, after reversing the stand, the opposite of the apples treated in the same manner. Treatment of different groups was varied—(1) By adjusting nozzle pressure from 100 lb. to 300 lb. per square inch; (2) by whorl-plate adjustment to vary the fineness of spray-droplets and the depth of penetration; (3) by adjustment in the distance of the nozzle from the fruit. Each experiment was carried out in triplicate. The spray was composed of 4 lb. lead-arsenate in 100 gallons of water.

Differences in cover effected by the various treatments were ascertained by observation, and in some instances by chemical analysis of spray residue. It was found that spray tended to collect to a varying extent in the depression surrounding the stem, and, since this did not represent normal coverage, the stem and portion of the skin was removed from each apple before the quantity of spray residue was estimated. The fruit was thoroughly washed before treatment, and unsprayed samples included for analysis with each experiment.

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† The types of cover discussed in the present paper are those formed in the absence of commercial wetters or spreaders.

In order to determine the influence of variation in the nature of the surface sprayed, mature plums and peaches were included in the different treatments.

RESULTS OF EXPERIMENTS WITH APPLES.

(1) *Nozzle pressure.*—Increase in nozzle pressure from 100 lb. to 300 lb. improved the distribution of spray on the fruit, the size of the droplets of spray being reduced but the number considerably increased. When the nozzle was held at a distance of 2 ft. from the apples it was found that draught from high pressure tended to remove the droplets of spray from the sides of the apples farthest from the nozzle. This effect was reflected in the measurements of spray residue, which showed an average per group of apples of 3·3 mg. arsenic-trioxide at 100 lb. pressure and 3·1 mg. at 300 lb. pressure. With increase in the distance between the nozzle and fruit the blowing effect of high pressure was reduced, an experiment with the nozzle 4 ft. from the fruit showing an increase in spray from 3·65 mg. at 100 lb. pressure to 4·7 mg. at 300 lb. pressure.

(2) *Whorl-plate Adjustment.*—Adjustment in the whorl-plate so that the spray formed was varied from relatively coarse droplets with high penetration to fine droplets with inferior penetration resulted in improved coverage, the difference being apparent in a reduction in the size and increase in the number of spray-droplets remaining on the fruit. The average amount of arsenic-trioxide recovered from. the group of apples was increased from 3·7 mg. where the spray applied was of relatively coarse droplets with high penetration to 3·5 mg. where the penetration was lower and the droplets of spray finer.

(3) *Distance of Nozzle from the Fruit.*—Increase in the distance of the nozzle from the fruit up to 8 ft. resulted in improved coverage. At the greater distances certain of the droplets of spray remaining on the fruit became comparatively large in size before run-off occurred, whilst in the intervening spaces fine droplets of spray remained to form an almost complete cover. Estimation of spray residue showed that the average amounts recovered per group of apples increased from 3·1 mg. when spraying at 2 ft. to 4·7 mg. at 8 ft.

RESULTS OF EXPERIMENTS WITH PLUMS.

Differences in spray coverage resulting from the various treatments were similar to those obtained on apples. In each treatment, however, the coverage obtained on plums was inferior to that on apples.

RESULTS OF EXPERIMENTS ON PEACHES.

In these experiments two distinct types of cover were obtained—(1) That in which the spray remained as drops resting on the hairs covering the fruit; and (2) that in which the spray penetrated between the hairs and formed a continuous film.

The former type of coverage was obtained where a spray of fine droplets with poor penetrating-power was used.

Increase in pressure, adjustment in the whorl-plate to produce a more driving spray, and reduction in the distance between the nozzle and fruit all assisted towards obtaining the latter type of coverage.

DISCUSSION.

It is apparent that spray coverage is largely influenced by the conditions under which the spray is applied and by the nature of the surface sprayed. Variation occurs not only in the distribution of the spray, but in the total quantity of residue remaining on any given area.

On surfaces which are rough—*e.g.*, bark, pear fruits of certain varieties, &c.—it is relatively easy to obtain a continuous cover of spray.

Where the surface sprayed is smooth—*e.g.*, most apple fruits—the spray remains on the fruit as isolated drops, relatively large in size, with the adjacent spaces filled to a varying extent with finer droplets. It was not found possible to obtain a continuous cover of spray on a smooth surface other than by the aid of wetting or spreading agents. Improvement in cover is obtained by the use of a nozzle (or combination of nozzles) forming fine droplets of spray and by applying the spray under high pressure (250 lb. to 300 lb.) with the nozzle held sufficiently distant from the fruit to avoid removal of spray by the blowing effect of high pressure.

" Waxy " surfaces such as the surface of most plum fruits are difficult to cover effectively. The best results are obtained under conditions similar to those applying to " smooth " surfaces, but even under the most favourable circumstances the coverage is often poor, the drops of spray being isolated with comparatively large areas apparently free of spray.

The " hairy " type of surface, represented by peach fruits, can be covered with a continuous film provided the spray is applied with sufficient force to penetrate between and wet the hairs. For this purpose a nozzle giving a relatively coarse spray with high penetration is required. Maximum nozzle pressure should be maintained and the spray applied with the nozzle held as close as possible to the fruit.

METHOD OF APPLICATION.

The attainment of maximum coverage is largely dependent on the personal efficiency of the operator. As a rule the more exposed parts of the tree are rarely missed, and in order to assure that those parts which can be less easily seen are covered it is essential that the spray be applied systematically and from as many directions as possible.

The most satisfactory results are obtained by completing each tree before commencing the next. In some instances, however, the method adopted is to work along a row of trees, spraying half of each tree, and to complete the spraying from the other side of the row. The latter appears to reduce the amount of walking required, but unless carefully carried out may result in parts of the tree being left unsprayed.

The structure of the trees as influenced by pruning methods is of considerable importance in determining the efficiency of application. The main points of significance in this respect are that the centres of the trees should be kept open, the presence of duplicate leaders avoided, and the laterals well spaced. Early thinnings of the bunches so that not more than two fruits are left together assists in obtaining maximum coverage.

CARE IN DRENCHING SHEEP.

By L. W. N. FITCH, Veterinary Laboratory, Department of Agriculture, Wallaceville.

DURING the past months there have come to our notice several cases of abscess formation in the lower jaws of sheep. In many cases a fair number of sheep have been affected in a single flock, and the trouble has caused much consternation in some cases where valuable sheep were involved, as the condition is not infrequently followed by death.

These outbreaks have not been confined to any single area, and it has been found that they are in all cases preceded by the use of an automatic drenching-gun. These guns have in some cases a very rough nozzle (due to being bitten on by sheep) and this, in some cases, in combination with incorrect drenching technique, has been responsible for damage to the delicate lining membrane of sheep's mouths. In addition, a certain amount of the drenching-fluid may be forced into the tissues causing still further damage.

In addition to the damage as described above, and still more important, is the fact that the mouth is teaming with bacteria which gain access to the deeper tissues through the abraded surface and multiply there, with the result that abscesses are formed. These abscesses vary considerably in character. Some are very acute and may cause the death of the animal from toxæmia within a few days. These may never burst to the exterior but burrow their way through the tissues, which are destroyed by toxins. One such case seen at the laboratory had actually spread to the jugular vein, the wall of which had given way, with the result that the sheep bled to death. Others may be less acute and may burst under the jaw, when the prospects of healing are much better, of course. Still others may never burst, but, after say ten to twelve days, may be felt as a hard, firm swelling of inspissated pus, which will gradually be absorbed.

The contents of these abscesses varies from a dirty, brownish, watery mixture to a thick, creamy pus, depending on the nature of the infection.

TREATMENT.

The rational treatment is, of course, prevention. This is achieved by careful and correct drenching technique and by taking care that the drenching-gun nozzle is not rough. A picture is appended showing the correct way to drench sheep. The method is as follows :—

The sheep are in a crush or small pen, and the operator stands alongside or astride the sheep. The sheep is allowed to stand as naturally as possible, as excessive restraint only makes the animals struggle. The sheep should not be up-ended on to its rump. The operator holds the sheep with his left hand, the lower jaw being held with the thumb in the interdental space—*i.e.*, between the front and back teeth. The gun is now put into the sheep's mouth from the side, the nozzle run backwards towards the base of the tongue, and the dose delivered At the time of delivery of the dose the end of the nozzle should rest on the base of the tongue and be directed backwards, and not sideways, at an angle to the jaw. If this is not done part of the dose may be lost, and further, damage may be done the gums.

If these simple directions are observed, there should be no damage to the mouth, with a consequent absence of maxillary abscesses. Further, the chances of pneumonia resulting are reduced to a minimum. Curative treatment is of limited value, and consists chiefly in providing good drainage to the abscess by opening at the correct stage, and irrigation with disinfectants. A further aid to prevention may be the addition of a piece of rubber tubing to protect the nozzle.

CORRECT METHOD OF DRENCHING SHEEP.

One must distinguish the above-described condition from another type of abscess sometimes seen in the lower jaws of sheep. These are usually further forward in the jaw and run a longer course. They are due to the penetration of grass-seeds between the teeth and gums, or, in some cases, through the covering skin. The bone itself is often affected in these cases, and the jaw may be greatly deformed. Such cases frequently result in death.

The Fields Instructor, Masterton, reports that a farmer in the Akitio district has been top-dressing his hill-country with super for the past six seasons, doing approximately one-third of the farm annually, and has just completed twice around the property. Previous to top-dressing his carrying-capacity was 1,000 ewes and 1,000 dry sheep, very little going off the place fat. To-day he carries 2,000 ewes (about half to Southdown rams) and 200 dry sheep, all surplus going away fat.

COMB HONEY.

ITS PRODUCTION AND MARKETING.

H. F. DODSON, Apiary Instructor, Palmerston North.

THE production of comb honey is generally regarded by beekeepers with disfavour or indifference. This is associated with production and distribution problems. Two smaller problems are the reluctance of bees to undertake this particular form of storage and the lack of skill on the part of the apiarist to deal with the bees' reluctance. For these latter reasons, many amateur beekeepers eschew comb-honey production. The indifference of the commercial man, however, lies in the former and less easily surmounted obstacle—distribution.

The commercial apiarist realizes the difficulty—almost the impossibility—of selling large quantities of comb honey in sections—and present-day prices demand a large turnover in any form of honey. He also knows that sections require very careful handling and packing. If one breaks, it is usually in the top row that this occurs, and it then weeps honey all over the cappings of the undamaged sections below.

The main problem of production is the weather. A rapid and constant flow is very necessary for raising first-class sections. It is true, however, that a good average season for extracted honey will usually yield a good average crop of comb honey, provided the hives are in a fit and proper condition.

There is a potential market for comb honey in New Zealand. A large section of the community prefers honey in this form and some will take no other kind of honey. But haphazard methods will bring no results.

Honey in the comb is regarded by many people as being honey in its most natural condition. Without any doubt it is the most natural form of honey. The extracting and tinning of honey is a comparatively modern process, and one that has been evolved to meet a larger need—an ever-growing demand for honey in a cheap and serviceable form. The mass production of honey is filling that need

But honey in the comb remains the unchallenged choice of the epicure; and, no matter how fine the grain and flavour, nor how beautifully designed the tin and its label, extracted honey can never enter the same class as comb honey. Honey that has been stored by the bees and sealed at exactly the right moment, honey that has been in contact with nothing but the flowers of its origin and the bees who gathered it as nectar, storing and sealing it in the waxen cells of their own manufacture—such honey bears its own seal of purity.

The fundamental difference between the raising of sections and the production of extracted honey is that, whereas the bees like straight comb, they intensely dislike sections. In drawing out full sheets of foundation, the bees are able to cluster to their hearts' content. The drawing-out of sections, however, involves the breaking-up of the cluster into smaller ones, only a few inches square. The bees' dislike to this arrangement is a perfectly reasonable one, because the secretion of wax by their wax glands depends on the heat they are able to generate. The bigger the cluster, the greater the heat.

The key to the whole business so far as the apiarist is concerned lies in that one central fact—the bees must be induced to want to cluster on the sections. If the bees' problem is that the breaking-up of their cluster reduces the heat, then the apiarist must see to it that there are sufficient numbers of bees in the hive to build up a solid wall of reserves behind these divided clusters for relieving them and for maintaining the temperature in the super. At the same time it is also important to see that the hive is well above the ground, allowing a plentiful supply of fresh air to circulate. Heat in this case must not be confused with stuffiness, which will cause swarming more quickly than anything.

Hives that are to yield a good crop of first-class sections must be strong colonies with a large force of young bees as well as a good foraging force. The first step, then, is to build up a powerful colony from a young and vigorous queen that will keep the hive well stocked. Assuming the colony to have been wintered in one box, it should be built up during the spring into two boxes full of brood and bubbling over with bees. All emerging brood and the queen should be kept in the bottom box, only eggs and very young larvæ being allowed in the second box ; the two outside combs may be empty. Any emerging brood over the ten frames should be given to other hives requiring them. As the bees hatch out, the queen has room to lay, and the bees have the two outside frames in the second box in which to store any honey that may come in.

In districts where there is an early flow of dark honey, it is very sound to add a super as soon as the flow starts. This may be judged by the whitening of the tops of the combs. The bees take possession of a super of drawn comb very readily as honey starts to come in, and a super of dark honey makes excellent feed and develops in the bees the idea of storing upstairs. The brood manipulation already referred to keeps the queen below, and as the flow develops into a better quality the hive is approaching a condition where good habits are being practised.

The next step is concerned with creating a desire in the bees to draw out the sections. There are many and varied plans for doing this. The late Dr. C. C. Miller, one of the most successful producers of comb honey, used what he termed " go-back " sections to act as baits. That is to say, he used to put unfinished sections from the previous year in with the undrawn sections to tempt the bees into the super. For those intending to take up section-raising Dr. Miller's book " Fifty Years among the Bees " can scarcely be equalled.

Jay Smith, an eminent American beekeeper, uses a system of raising sections and extracting combs in the same box. This is an excellent plan, and should commend itself to New Zealand beekeepers where the vagaries of the weather are so pronounced.

An ordinary section super holds seven frames. One of these should be removed ; on each outside an extracting-frame containing fully drawn, empty comb should be placed. This super is then ready to be added. Immediately this is given to the bees that are crowded for space they start to store in the two outside combs. They are thereby instantly attracted to the fresh story : they start to occupy it at once and to work in it at once. As the season opens up they fill and seal the outside frames, and, working on to the section frame next to it, gradually extend towards the centre. Of the numerous methods used and advocated, this is the simplest and appears to bring the best results.

As soon as it is filled, the super of early honey can be taken off and replaced with the prepared super of sections. If a half super is used, the clusters that were working on the super just removed are forced into half the space. This is advantageous, as it gives that extra concentration so necessary for sections. Another advantage is that a half super takes only half the time to complete. This means that the sections are on the hive only half the time, and in consequence do not become so travel-stained.

The machinery of distribution cannot be dealt with adequately in this article, but the following outline of possible action is designed to give some guidance.

The first thing to realize is that people do want comb honey, and if people want a thing they are usually prepared to pay for it.

If people want to buy something, a merchant is immediately interested, but he has to be satisfied that they really do want to buy and will keep on buying.

The beekeepers have their own commercial organization which exists for the purpose of distributing honey to people that want it. But before such an organization can be utilized, the producers have to show conclusively first that they can and will produce, and, secondly, that, having produced, there will be no difficulty in disposal.

The first step in this direction is co-operation. The beekeepers in a given area should combine and produce comb honey, packed in cellophane with a cardboard container, and standardize their quality and price. The commodity must be standard, of high quality, and an attractive pack. A distributing organization would willingly handle such a commodity.

In favour of extracted honey we have an additional tonnage and the retaining of the comb and the cappings. The amount of labour involved is, contrary to the general notion, about equal, unless the producer exports all his honey in 60 lb. tins, in which case labour is a larger cost in the case of sections.

It is difficult to determine accurately what crop of sections in ratio to a crop of extracted honey may be taken in any given season. The ratio alters according to the length and quality of the flow. In a first-class season the crop of sections would be much nearer the extracted crop; in a poor season, yielding no sections, a fair crop of extracted honey might be gathered. The capital outlay required for running a few hives for comb honey is far less than that required for equipping an extracting house.

Finally, as the production of comb honey is still in its infancy, a word of caution seems warranted. It would not be wise for any one at this juncture to produce comb honey too extensively. The purpose of this article is to demonstrate that comb honey can be successfully produced under normal conditions, and that there is a potential market capable of absorbing large quantities. The apiarist who desires to pioneer this comparatively unexplored branch of the honey industry must be prepared to build up from small beginnings, either by himself or in conjunction with other apiarists, the production of a first-class commodity and a collateral suitable marketing organization.

SEED-WHEAT CERTIFICATION.

THE following is a list of growers for the month of May whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably sealed and tagged. (Previous lists, to which those interested are referred, appeared in the March, April, May, and June *Journals*) —

Variety.	Grower.	Acreage.
Cross 7	Brophy, K.	13
	Forster, J., Washdyke	6
	Henderson, W. L., Teschemakers, Waimate, R M D	15
	Kean, C A., Limehills	3
	Pemberton, S , Winchester	30
	Talbot, C J and G W., Fairlie ..	19
	Talbot, P. R., Claremont, Timaru (Line A)	30
	Watson, D M , Methven	11
Dreadnought ..	Medlicott, F S , Hook	10
	O'Sullivan, E D , Park Road, Albury ..	16
	Ruddenklau, H , Estate of, Waimate ..	20
Hunters II ..	Ford, W , Eiffelton, R M D	11
	Horsnell, H S., Morven	8
	Hunter-Weston, R P , Albury ..	9
	Miller, P H , Fairlie	10
	Ruddenklau, H., Estate of, Waimate ..	32
Solid Straw Tuscan	Brunton, D , Otaio	30
	Darling, S , Seadown	6
	Dickson, A M , St Andrews	8
	Gosling, A , Claremont, Timaru ..	10
	Henderson, W L., Teschemakers, Waimate, R.M D.	15
	Lynskey, M , School Road, Yaldhurst ..	14
	Lysaght, T., Tripp Settlement, Geraldine (Line B)	10
	Medlicott, F S , Hook	12
	Ross, C E , Laghmor, Ashburton ..	20
	Tozer, W. J, Rangitira Valley, Temuka ..	12
	Waller, G , Tripp Settlement, Geraldine (Line B)	7

—*Fields Division.*

The Sixth Conference of the New Zealand Grassland Association will be held in Dunedin on August, 10th, 11th, and 12th. Non-members as well as members are invited to attend. The subscription of membership is 5s. per annum.

Use of Cow-shed Wastage.—The matter of utilizing droppings and washings from sheds and yards is receiving considerable attention: already fifteen plants are all working satisfactorily, and good results are being secured from the operation. An estimated cost of the outlay is as follows: Sump, 500-gallon capacity, cement-lined, own labour, £7; hand pump, 6 ft. lifts 1½ gallons per stroke, £4 17s. 6d.; tank, painted, £6; sledge, complete with fittings, £10 10s. (drawn by one horse, or two in wet weather: total, £29 (approximately). One farmer with a 110-cow herd in one shed runs the washings straight into his tank and spreads them every day; but most men provide a sump of 500 to 2,000 gallon capacity and top-dress when convenient. Odd cases of trouble over grit carried in on the hoofs of animals affecting pump-washers are reported; but one man has installed a diaphragm pump costing £15, which is doing good work.—*Instructor in Agriculture New Plymouth.*

SEASONAL NOTES.

THE FARM.

Bearing of Pig-keeping Position on Cropping Programme.

FOR the present at least the United Kingdom is practically the only export market for New Zealand pig products. The present position has not changed materially from what it was in 1936, when the United Kingdom imported 363,124 tons of bacon and hams, 5,800 tons of fresh pork, and 51,400 of chilled or frozen pork, a total of 419,524 tons of pig products ; in the same year the imports of frozen lamb and mutton totalled 315,626 tons.

The 51,400 tons of frozen or chilled pork imported in 1936 included 29,028 tons imported from New Zealand, this being 56 per cent. of the total.

When the quantitative relationship between the pork and the bacon imports of the United Kingdom is taken into consideration, it becomes clear that any substantial increase in the number of carcasses of porker weights exported would involve a distinct danger of over-supplying the market with the usual influence of this upon prices.

In the face of this position greatly increased output of pig products for export by New Zealand is considered both easily possible and highly desirable, but as a glutted market is invariably unsatisfactory to the producer the increased production of pig products to be of the fullest economic value clearly must be correlated with the production of a greater proportion of carcasses of baconer-weight, and the proportion of such carcasses must become progressively greater as our exports grow. In view of the market position it is gratifying that there already is a distinct trend to an increased proportion of carcasses of baconer-weight and slaughterings for export: in 1932–33 there were 53,608 bacon carcasses in a total of 310,389 carcasses, while in 1935–36 the corresponding figures were 219,690 and 679,561 while the position is still better in the elapsed portion of the current producing-year, the figures for eight months to the end of May being 239,162 baconers in a total of 642,669 carcasses.

Practices already being carried out with economic results by certain farmers, if adopted more generally, will enable the present desirable trend in the porker-baconer ratio of production to be intensified when and as this is necessitated by further growth in our pig industry. An important one of these changes is the wintering of store pigs. A report of an investigation by the Manawatu–Oroua Pig Recording and Development Club relative to the wintering of pigs was published in this *Journal* in January last. The investigation covered a period of sixty days in May to July : the initial live-weight of the pigs was approximately 70 lb. (other experience suggests that much smaller pigs would not fare so well), and the pigs made an average daily gain of ½ lb. a pig. The feeding-stuffs used were barley, peas, mangels, pumpkins, and meat-meal. In assessing the feeding-cost of wintering, barley, peas, and meat-meal were charged at 1d. per pound, and roots were charged at 12s. 6d. a ton. The cost of the feed on this basis was 8s. 9d. a pig. The commercial difference in price between a 70 lb. pig in the autumn and the same pig in the spring having grown in the meantime at the rate of ½ lb. daily is always much greater than the sum of 8s. 9d. One point of great practical importance is that pigs wintered in the way described are available to consume very effectively the dairy by-products in the spring and develop to bacon weights relatively early in the new producing-season.

Further, by wintering pigs in this way the farmer often can solve the problem, which otherwise may be difficult, of how to handle satisfactorily second litters within the one year: the proper wintering of pigs mainly on home-grown feeding stuffs is likely to be much preferable either to selling them as somewhat small porkers or as stores at " sacrifice " prices. The rations used in the investigation were—(1) Barley, meat-meal, and pumpkins; (2) barley, peas, and pumpkins; (3) barley, meat-meal, and mangels; (4) barley, peas, and mangels. The principal results are in complete conformity with a considerable amount of practical experience.

Special Crops for Wintering of Pigs.

From the results of the investigation and of considerable supporting practical experience it may be deduced that when the yields of mangels, pumpkins, peas, and barley are tolerably good following a reasonable standard of efficiency in their culture, then these crops may profitably be grown for use in the winter feeding of pigs. Outside the milder northern districts the yields of pumpkins seem as a rule to be too low to justify using the pumpkin in place of the mangel. The mangel may at times not be mature early enough to be fed with safety to pigs when the feeding of roots first becomes desirable. To provide for such a possibility such crops as swedes, chou moellier, and carrots may be grown for use before the mangels have ripened, and in conditions well suited to good yields from these three crops they may quite well be used to displace the mangels largely or even completely.

It is not always realized that home-grown peas and barley can be used very efficiently in pig-keeping without the necessity for outlay on special machinery, such as a binder, which is not part of the regular equipment of dairy-farms, and without the bother and expense of threshing such crops. In actual practice these crops are being harvested quite well by mowing, and pigs being excellent gleaners no wastage of consequence occurs when they are given unthreshed peas or barley.

In the warmer districts, where reasonably good yields from barley and peas cannot be depended upon, experience has indicated that maize grain may be used with great success in the wintering of pigs. Full information about the crops that suitably may be grown in specific districts for the wintering of pigs and about the culture and use of such crops may be obtained from local officers of the Fields Division.

In planning the wintering of pigs it should not be overlooked that pastures and kindred crops such as green leafy cereals have frequently been employed with success to contribute a substantial portion of the ration of pigs. Further, success from pastures and kindred crops used in this way cannot be expected unless the crops are at a leafy as distinct from a stemmy stage of growth and unless they are available in adequate amounts. Pigs may be grazing on leafy pastures which are grazed so closely that the pastures actually contribute very little to the daily ration, and in such circumstances poor results may be expected.

Breaking-up of Pastures.

A most important question that arises at this stage in the year's work is the acreage and location of the grassland it is advisable to put under the plough during the coming season. One of the main matters that should be given consideration in deciding the answer to this question is what area of special crops—such as mangels, swedes, turnips, chou moellier, carrots, and cereals—it is desirable to grow to ensure adequate supplies of feed when that available directly from grassland is likely to be below the requirements of stock during the critical periods in late summer and in winter and early spring. This should be considered in conjunction with the area it is proposed to utilize for hay and silage. Of considerable practical importance in connection with the provision of special feed is the fact that generally the provision made for the critical seasons is less than is required for full economic feeding of stock, and that, especially in dairying, but also in sheep-farming, there often would be more profitable results were the plough used more freely as a step towards better feeding during those periods when the feed from pastures usually is too scant.

Another important matter sometimes ignored is that breaking-up of pastures may be the most economic course to adopt when the improvement of inferior swards is sought. This matter was dealt with at some length in these notes last month.

Pastures Inferior to Their Natural Conditions.

Quite frequently pastures are of lower production than is warranted by the natural conditions under which they are growing. Expressed otherwise, often the land is capable without the aid of such practices as top-dressing or draining of supporting more productive pastures than the existing ones. There are three common causes of this state of affairs—(1) Ravages of the grass-grub ; (2) use of inferior strains of pasture species ; (3) grazing management which leads to deterioration and lessened production of swards.

The ravages of the grass-grub are obvious, and at this season they call for the feeding-out of hay, silage, &c., on affected areas, and especially for the feeding-out of any hay in which useful plants contain seeds mature enough to be viable. Further, if the land responds to any form of top-dressing, then that form of top-dressing is advisable for the purpose of increasing the vigour of plants and stimulating their recovery from root-damage. However, so far, no type of top-dressing—*e.g.*, with lime salt, &c.—as a direct means of attacking the grubs has been found of value.

The use of inferior strains of pasture-plants which either are not persistent or are of low production, even under conditions of high fertility, is a frequent and fruitful cause of poorer pastures than the natural conditions warrant. The remedy is simple and normally can be carried out at a cost which makes its adoption distinctly profitable : it is the use of seed of the characters possessed by certified seed.

The most usual type of grazing management which leads to deterioration and lowered production of pastures is unfortunately very common ; it is that in which unduly hard grazing takes place continuously in the winter and early spring and this is followed by insufficiently close grazing for most of the early summer. This type of grazing results in the punishment at a critical stage in each year's activity of species which make early growth—*e.g.*, rye-grass—and of the strengthening of species which make late growth—*e.g.*, brown-top. This tends to the eventual dominance of the brown-top and the suppression of the rye-grass. Ordinarily such a result is most readily avoided by one or both of two distinct courses—(1) Increased ensilage or haymaking which each reduces the summer surplus and builds up the winter feed-supply so that it tends to correct the grazing fault at both seasons ; (2) the growing of special arable forage crops for use in winter, which likewise tends to correct both grazing faults.

From the preceding brief outline it becomes evident that the whole pasture position on individual farms may very fittingly be reviewed at this stage in the year's work if it has not already been done ; the field work that should be done during the next few years and especially during the next twelve months should depend to a considerable extent upon the current general position on the farm in regard to grassland.

Care in Winter Grazing.

Young pastures, and especially those in which permanency is desired, should be treated with much care at this season. " Poaching " or " pugging " leads to bare patches by means of which weeds gain a footing—

it is at times the primary cause of great numbers of such weeds as docks, buttercups, daisies, and thistles suddenly appearing. Sheep lessen the danger of "pugging" in comparison with cattle.

In trying to avoid "pugging" of young pastures one may fall into another fault—unduly lenient grazing—which readily brings about weakening of valuable species such as clovers. Young permanent pastures containing a considerable amount of Italian rye-grass are very prone to suffer from under-grazing because of the shading effect of the rye-grass upon the more slowly developing species. The other fault—over-severe grazing of young pastures—is in August the more prevalent one: it results in a setback to valuable species from which they may never recover fully.

General Cropping Work.

In the main grain-growing districts the ploughing of land for cereals should take precedence over almost all other work. As a rule the best yields of spring wheat result from sowing in August and early September. The sowing of oats ordinarily should follow wheat as soon as opportunity offers.

Seed-treatment for disease-control of spring-sown cereals should not be omitted. The treatment of seed of oats and barley is more neglected than that of wheat, but nevertheless is well justified. Recent years have been marked by advances in seed-treatment associated with increased convenience and safety without sacrificing efficiency and economy, but strangely enough the advances in our knowledge are far from generally applied in practice. It is of importance that certain popular forms of seed-treatment must be carried out with exactitude. If the proper procedure is not followed carefully, one of two undesirable results is likely: either the disease is not controlled or the seed suffers injury. Sometimes injury is so extensive as to lead to the need of resowing or to a poor yield or to both resowing and a poor yield. Detailed information about seed-treatment is available from the Department of Agriculture.

Autumn-sown cereals if they are to produce chaff or grain should be given a final grazing about the end of August. However, if because of the high fertility of the land "lodging" is expected, then the final feeding-off may quite well be deferred until September. Generally after the final feeding-off the crop may with advantage be tine-harrowed to loosen the surface and to distribute droppings as thoroughly as possible Feeding-off of cereals in the spring should be done by heavily stocking the area for a short period, and this preferably when the soil is as dry as possible. Harrowing of autumn-sown wheat may serve usefully to thicken thin crops, even when they have not been eaten off, by promoting tillering.

Winter Utilization of Crops.

Faulty winter feeding often results when rations are not suitable in quality as well as quantity. It is not enough merely to provide a ration which fills the stomach—the required amount of nutriment should also be present. The feeding of stock mainly on straw or poor hay may be expected to result in poor nutrition, because the diet thus provided is too bulky in relation to its content of digestible nutritive matter. The feeding of roots alone leads to too much watery bulky material in the animal's diet. While it is mainly the bulkiness of roots which makes them unsuitable as a complete diet, straw and poor hay are unsuitable because both of their bulkiness and low digestibility.

If possible, grazing of lucerne during winter and early spring should be avoided: this is especially so in the case of young lucerne. Such grazing promotes the invasion of the lucerne by other plants, which, even if of some value—*e.g.*, rye-grass and clover—must be looked upon as weeds in the lucerne.

If any pastures are showing signs of grass-grub damage, but are not so extensively damaged as to be not worth repairing, then during the next few weeks the feeding of hay, silage, and roots may usually be concentrated profitably on them : at this stage the grass-grubs return to near the surface from considerable depths, and so they are more subject to injury by the trampling of stock. Further, the trampling and the extra fertility induced by the feeding-out seems to be of value in assisting injured plants on which remnants of roots remain to recover more readily.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Pruning.

EVERY endeavour should be made to complete this work as early as possible so that it will be finished before the spring activities—cultivation and spraying—are commenced. With regard to pruning, following the advice given in the notes of the previous months, those who have any difficulty in respect to the manner in which any particular trees should be pruned are advised to communicate with the Orchard Instructor stationed in the district and seek his advice.

All prunings, orchard refuse, and rubbish should be gathered and buried, either as the pruning proceeds or immediately it is finished. This is the surest and best way of destroying any pests and diseases of the trees which may be present in such materials.

Spraying.

The overhaul of the sprayer before the spraying-season commences will save growers much loss of time and inconvenience later in the season. A thorough examination should be made of the machine, and all damaged or worn-out parts should be repaired or replaced. The moving parts of the pump and engine should be thoroughly cleaned and regreased. Examine and test the hose, and if faults are found new hose should be obtained. A supply of spare parts for repairs in case of emergency during the season should be obtained.

The fruitgrower has to contend with a large number of pests and diseases. Some of these cause extensive damage to the trees and the crops. Every grower should make a determined effort to decrease the amount of disease present in his orchard by orchard sanitation and spraying.

The first essential in treating insect or fungous disease is that the grower should identify correctly the pest and know something of its life-history in order that it may be correctly classified and the proper remedies applied for its control. After becoming acquainted with the life-history the orchardist has to consider and decide on a remedy which can be effectively applied. The remedies most commonly applied are briefly as follows :—

(*a*) *Poisons for Chewing or Biting Insects.*—An arsenical poison—arsenate of lead—which acts upon the stomach is the specific in general use for the control of codling moth, leaf-roller caterpillar, and pear or cherry slug, &c.

These should be applied to the foliage and fruit just before the pest makes its appearance.

(*b*) *Contact Sprays for Sucking Insects.*—The insects must be present when these sprays are applied, and the specifics are most efficient when they come in contact with the bodies or are inhaled through the breathing organs of the insects. At the present time lime sulphur, nicotine sulphate, winter (red) oil, and summer (white) oil are in most general use as contact sprays for the control of red mite, apple-leaf hopper, green and black aphis, and scales.

(*c*) *Fungicides for the Control of Fungi.*—The specifics should be applied before the spores of the disease have an opportunity of germinating and establishing themselves on the plant or fruit tissue.

Lime sulphur, bordeaux mixture, and colloidal sulphur are the fungicides in most common use for the control of black-spot, powdery mildew, leaf-curl, brown-rot, rust, shot-hole, and other fungous diseases.

(*d*) The use of the secateurs and the saw is recommended for the cutting-out, where practicable, of parts of trees badly damaged by insects, fungi, or bacteria.

Cultivation.

If the land has not already been ploughed, every effort should be made to complete this work as soon as possible, so that cover-crops, grass, and fallen leaves, &c., may be turned in. This will give the crops and other vegetable matter turned in time to rot, and the elements which it contains will be made available when the tree requires them in the summer, when the fruit is maturing. Leaves affected by disease such as black-spot, for instance, will be buried and will have rotted, thus preventing the dissemination of disease from this source during the spring.

Planting.

Growers intending to plant in the spring should arrange for early delivery of the trees, and, on their arrival, they should be " heeled in " in a suitable place at or near the orchard, ready for planting towards the end of August. The ground should be reasonably dry, and, if wet, the planting should be delayed until a later date, when the soil is in a suitable condition.

Fruit in Storage.

This should now be examined frequently. Growers are advised to dispose, without undue delay, of fruit which has begun to shrivel or is showing signs of wilting or over-ripeness.

—*B. G. Goodwin, Orchard Instructor, Christchurch.*

Citrus Culture.

Packing.—Last month notes on the packing of citrus fruits were given, the main points dealt with being the building of the bulge and the elimination of slackness in the pack. The type of packs used will now be dealt with. In the case of lemons and sweet oranges the fruits are packed on the " cheek " and the style of pack and the counts per box are the same as those used for apples and pears, except that the 3-2, 7-6, 5-layer 163 pack is seldom used, as it is generally not possible to get seven lemons in the rows lengthways. In its place the 3-3, 5-4, 6-layer pack of 162 is used. As in the case of " Small " grade lemons the sizes allowed are 270 to 350 counts to the standard box (10½ in. by 11½ in. by 18 in. inside measurement), the packs in these instances are not included on the apple-packing chart. A lemon-packing chart recommended reads as follows :—

Style of Pack (Crosswise).	Number in Rows (Lengthwise).	Number of Layers (Depth).	Size or Count.
3-2	5-5	5	125
3-2	6-5	5	138
3-2	6-6	5	150
3-3	5-4	6	162
3-3	5-5	6	180
3-3	6-5	6	198
3-3	6-6	6	216
3-3	7-6	6	234
3-3	7-7	6	252
3-3 (*a*)	8-7	6	270
3-3 (*a*)	8-8	6	288
4-3 (*a*)	6-6	7	294
4-3 (*a*)	7-6	7	319
4-3 (*a*)	7-7	7	343
4-3 (*a*)	8-7	7	368

The last six packs marked (*a*) are applicable to "Small" and "X" grades only. Lemons of this size are of little commercial value unless they are highly cured and full of juice.

The method of packing New Zealand grapefruit differs from that used for other fruits in that it is usually packed on the flat instead of on the cheek, and, as this method gives different counts to those obtained in packing in the ordinary way, a chart for use with the standard bushel case, for New Zealand grapefruit (Poorman orange) only, is given below:—

Style of Pack (Crosswise).	Number in Rows (Lengthwise).	Number of Layers (Depth).	Size or Count.	Approximate Diameter.
				Inches.
2-1	3-3	5	45	4¼
2-2	3-2	5	50	4⅛
2-2	3-3	5	60	3⅞
2-2	4-3	5	70	3¾
2-2	4-4	5	80	3⅝
2-2	5-4	5	90	3⅜
2-2	5-5	5	100	3¼
3-2	4-3	6	105	3¼
3-2	4-4	6	120	3⅛
3-2	5-4	6	135	3
3-2	5-5	6	150	2⅞
3-2	6-5	6	165	2¾
3-2	6-6	6	180	2⅝

NOTE.—See packs on the flat.

Green Spot.—This condition was described in the notes for March last, but is referred to again as it has been much in evidence in packing-sheds during the past few weeks. The trouble occurs mostly on green fruit, and is accentuated when picking is carried out when the fruit is wet with rain or dew, although the primary cause is rough handling. Care should be taken to avoid the conditions which are conducive to this trouble, as green-spot lowers the grade of the fruit and consequently its value.

Replacements.—In many of the older groves there are trees which, owing either to the ravages of disease or to the fact that their constitution has been weak, have reached the stage when they are no longer producing a satisfactory crop. Generally these are allowed to remain in the grove far too long. The owner should decide whether there is reasonable hope of bringing the tree into full bearing again by skeletonizing it and by soil-improvement, or whether the tree must be cut out without further delay. If the tree has had root trouble very extensively or if it is almost completely ring-barked through attacks of "bark-blotch," then it should be removed. A young tree should do quite well on the old site provided that a large hole is dug and filled in with fresh soil.

—*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

Duck-keeping.

WHEN selecting breeding-ducks the same care and thought should be given as when selecting other breeding-birds. Firstly, select only pure-bred birds A study of the standard plates will indicate the type, while the letterpress thereunder states the breed characteristics. Vigour and constitution should be looked for, and the chief indication of this *sine quo non* is physical activity, together with a bright keen eye and well-developed body.

It is difficult to state a guide indicative of egg-production capacity in ducks, but on the whole it is advisable to select birds that show plenty of length, with ample breadth and depth. Good breeding-birds usually have large, bold, prominent eyes which are set high up in the head ; in fact, it is seldom that the duck with eyes set low down in the side of the face is a good producer. The neck should be fairly fine. The front should be full with a well-developed abdomen. Slight indentation should show between front and abdomen. Breadth across the back is essential, and the legs must be set well apart. Two points that should be watched are, firstly, that the weight for the breed is kept up, and, secondly, that the length of the body is maintained to standard.

Mating.

Only well-matured ducks should be bred from. As a rule ducks do not mature as early as fowls, but their laying-life is longer than that of the average hen. Two-year-old ducks mated to well-matured drakes at least ten months old will give good results.

As ducks are inclined to get overfat during their second and third years, especially after coming through the moult, they should be fed with care, as lack of care in this direction is often the cause of poor hatching results The number of ducks to mate with each drake will depend on the conditions under which the birds are kept, their vigour, and age, but, generally speaking, from six to seven ducks to each drake of the Indian Runners or Khaki Campbells, and four or five ducks to each of the heavy breed drakes, should give good results.

Where the birds are on free range, more ducks may be mated with each drake. It is usually an indication that the drakes are under-mated if they fight a good deal. As there is no sure way of judging exactly how any particular mating is going to materialize it is always advisable to take the utmost care to arrange that only the very best and strongest birds are used for breeding purposes. Though many ducks will refuse to lay in nests it is most desirable to encourage them to use nests by supplying them with simple nests, such as a few bricks placed about a foot apart against one wall of their shelter. If a little straw is placed between these bricks it is quite possible to train a number of ducks to use such nests, when their eggs can be collected in a clean condition.

Hatching Duck-eggs.

With the exception of the Muscovey, which take from thirty-five to thirty-seven days, all duck-eggs take twenty-eight days to hatch out, though many chip on the twenty-sixth day. Care should be taken to select eggs of good colour, shape, size, and texture of shell. Avoid the very large, bad-shaped, or rough-shelled eggs, as such eggs seldom hatch. It should be remembered that duck-eggs do not keep as well as hen-eggs, and that they lose their fertility more quickly. For these reasons they should be set within a week from the time of being laid ; in fact, the fresher they are when set the better. If hens are used for hatching purposes not more than from nine to eleven eggs should be placed under each hen. Better results will be obtained when the hen is set on the ground, and during the last week if the weather is dry it is advisable to sprinkle the eggs with a little warm water every other day. The hen can be quietly lifted off and replaced as soon as the eggs have been sprinkled. Care must be taken to see that the eggs are not chilled. Do not overdo the sprinkling, and if the weather is wet and the ground damp round the nest there will be no need for sprinkling.

The best results when hatching duck-eggs artificially are usually obtained when a little less ventilation and heat are allowed during the first week, and more moisture and ventilation during the last week of incubation, than that allowed when hatching hen-eggs.

The machine should be running at an even temperature of 100° F. when the eggs are first placed in the machine, and if the eggs are very cold the door of the machine can be left open for a few hours in order to allow the eggs to warm up gradually. If cold eggs are placed in an incubator and they are heated up too quickly, a number of broken yolks is likely to be the result. A temperature of 102° F. for the first week, 103° F. for the rest of the period until the eggs start to chip, when 104° F., not higher, may be applied, should give good results. During the last ten days the eggs should be sprayed with a little warm water (about 103°) each day. This can be done either with a small brush or with the mouth. If the eggs are cooled in the morning the spraying should be done at night, but remember not to cool and spray at the same time, as such action will most likely cause the eggs to become chilled.

The incubator-ventilators may be almost closed during the first ten days, after which the ventilators can be gradually opened, but once the eggs start to chip it is advisable to open up the ventilators and not close them as is often recommended when hatching hen-eggs.

Cooling and Turning.

The object of turning the eggs is to prevent the yolks from settling down towards the shell. The eggs should not be disturbed for at least thirty-six hours after placing them in the machine, then turn them once each day during the first week of incubation, and twice each day from then on until they start to chip, which is generally about the twenty-sixth day. It is essential that the eggs be handled gently, as jarring or rough handling is likely to cause deformed or crippled ducklings. As long as the eggs are moved gently it is not necessary that each egg be turned exactly over. It is, however, advisable to move them to different parts of the tray when turning, in order to give all the same units of heat, for all parts of the machine are not always exactly the same temperature.

During the first week the time taken to turn the eggs will be sufficient for cooling them, and then a few minutes extra each day until from thirty to thirty-five minutes are allowed during the last week. If it takes more than an hour and a half to get up the heat again, then less cooling should be allowed. The eggs should not be allowed to get cold, but be returned to the machine while just luke-warm. Never open the machine after the eggs start to chip until they have been given their full time to hatch.

Brooding Ducklings.

Ducklings are not difficult to rear and will give less trouble than chickens, but they must have clean, dry, well-ventilated sleeping-quarters, and a supply of drinking-water within their reach at all times. The drinking-vessels must not be too shallow. The ammonia from damp, dirty bedding and poorly-ventilated sleeping-quarters are the cause of watery or sticky eyes in ducklings, and many young ducklings are lost each year from blind staggers brought on from giving them a drink and a feed at the same time after they have been too long without water. As previously mentioned, if it is found when it comes to feeding-time that their drinking-vessels are empty it is better to give them a drink before feeding, and if the morning is cold the chill should be taken off the water. The food should always be well mixed and not fed lumpy.

When brooding ducklings artificially they need much the same treatment as that given to chickens, but they do not require heat so long, and if it is gradually reduced after the first week they will get on well without heat after three or four weeks, provided they have a dry, clean bed, are not overcrowded, and have ample fresh air.

As is the case with feeding chickens, some duck-keepers have success with one system and others with a different one. A great deal depends upon how one feeds. The following is one method that has given good results :—

The first feed, which is given from thirty to thirty-six hours after hatching, is composed of equal parts of pollard and bran and a little rolled oats or oatmeal plus about 5 per cent. of sand or oyster-shell dust, the lot mixed to a crumbly state with skim-milk. This is fed four times a day for the first five days. From the sixth day add about 5 per cent. of meat-meal and a small quantity of finely cut succulent green feed or boiled vegetables. After ten days increase the amount of meat-meal or boiled minced meat to 10 per cent., and also increase the amount of green feed. If on hand, maize-meal or barley-meal can take the place of the rolled oats. From two weeks' old three good feeds per day will be sufficient. Give all the brids will eat, but do not allow any food to be left to become sour. After the first week it is not necessary to mix sand with the mash, but it is essential that fine oyster-shell and gravel grit are always within reach of the birds.

When about eight weeks' old it is advisable to pick out the most promising birds for future breeders. Separate and fatten the rest for market by increasing the amount of maize-meal and barley-meal and reducing the amount of green feed. If ducklings have done well they should be ready for market at about eleven weeks old. When fattening for the market they need be given water to drink only at feed-time.

Ducklings must have ample shade from the sun, and the less they are disturbed the better. Ducklings can be hatched later than chicks, but if it is desired that young ones lay during April and May they should be hatched not later than October.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Preparations for New Season.

By the end of August the beekeeper should have his preparations for the season's work well in hand. Hive and frame making, also the overhaul of all defective supers, roofs, and bottom-boards, should be undertaken in earnest. It is not wise to postpone the mechanical part of the work in the apiary until the bees themselves require the major portion of one's time. If increase is desirable—more especially where the apiary is being enlarged—ample provision should be made for it. It is most tantalizing to leave a swarm hanging on a tree while a hive has to be hastily put together.

Where the beekeeper does not make his own hives he should now order sufficient stocks to see him through the coming season. In most cases it does not pay to make one's own appliances. Hive-manufacturing in New Zealand has been brought up to a high standard, and unless the beekeeper has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on these lines. Non-fitting supers and frames mean extra labour and lead to endless trouble in the long-run. The hives principally in use in the Dominion are the ten- and twelve-frame Langstroth, and experience of his district will enable the beekeeper to decide as to the best one to adopt. Careful inquiries should be made from beekeepers of long standing in the district as to the best style to use.

Cheap Frame Hive.

Though there may not be much gained in the long-run by making any other than good substantial hives in the first place (especially by those who can construct their own), there may be those to whom the question of saving a shilling or two upon each hive is a consideration. In such cases the following directions for converting a benzine-case into a frame hive of the same dimensions as the standard Langstroth and which complies with the Apiaries Act should be of service :—

Procure a complete and sound case and carefully take it to pieces, then rabbet the ends of one edge to a depth of ⅞ in. by ½ in. to carry the frames. A tin rabbet should be nailed on the inside, to stand ¼ in. above, on which the frames will rest. Now cut the sides so that they measure 20 in. Nail together, and this will give a hive the inside dimensions of which are 18¼ in. by 14¼ in. by 9⅝ in. A loose bottom-board may be constructed 24 in. by 15 in. wide. Nail on the board three strips of wood, ⅜ in. by 1 in., running along two sides and one end, so that when the hive is rested on the bottom-board it will leave an entrance ⅜ in. deep. Top of surplus boxes can be made in the same way. The best roof to use is a flat one. It may be made from the surplus timber of the benzine-case, and should telescope to a depth of 3 in. over the hive. Cover the top with ruberoid, zinc, or other waterproof material, and let it overlap the edges.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

MUSHROOM-GROWERS who had difficulty in keeping the shed temperature down in summer now find cropping curtailed by the low night temperatures experienced at this season, even with widely spaced beds and a heavy covering of straw. It is obvious the rough shed built of second-hand materials has a very limited use for growing this crop. To maintain a temperature of 50° to 60° F. at night during the winter period a fairly substantial building is required, unless the beds are made much deeper and well covered up, which is not to be recommended where the supply of compost is limited. For commercial cropping at all seasons an insulated building which can be thoroughly fumigated and sterilized is necessary. This is probably best provided by an asbestos-sheet lining with tightly packed shavings between it and the outer wall, which may be of asbestos or corrugated iron. The roof, outside, may be of iron, or timber covered with a thick burlap tarred and sanded. Well-fitted ventilators should be built into the base of the walls and in the roof, and the floor laid in concrete and drained. In the warmer localities very little artificial heating will be required in such a house, especially if it is built in a dry, well-drained position. The beds may be tiered at intervals of 2 ft. with at least 3 ft. between the top bed and the roof, and no straw covering need be used.

For cleaning, and to facilitate the working of the house, the bed boards of 8 in. by 1 in. rough timber should be laid loose ; also the 6 in. by 1 in. side boards for the beds. Where extensive cropping is done the bottom bed should not be placed on the ground, but on boards 8 in. to 12 in. above it. Catch crops may be grown in all sorts of places, but only so long as the conditions may be controlled for the necessary period. There are, however, usually definite limitations to the period when conditions can be controlled except in a building which is specially equipped ; such a place should therefore be provided where mushrooms are regarded as an important crop.

Growing of Asparagus.

The life-period of perennial herbaceousplants varies widely ; that of edible asparagus, *Asparagus officinalis*, is one of the longest—three or four years is the really productive life of most plants of this class, but good crops have been gathered from asparagus plantations four or five times as old as that. Apart from a good seed strain, production depends on good natural conditions and regular attention. This species is a native of Europe and Central Asia, where it is usually found growing by the sea-coast and river-banks. The light, deep, moist, well-drained soil found about estuarian flats in a temperate climate is its natural home, and such country should be selected for commercial production. The month of August, when the young plants are about to commence the new season's growth, is very suitable for setting out new plantations. For this purpose graded one- or two-year-old plants are best. There must be no doubt as to the eradication of twitch and persistent weeds of every kind, the ground must be thoroughly clean, and if not naturally rich it should receive generous dressings of organic matter, which should be turned in deep. This plant is very partial to supplies of potash and nitrogen ; a generous potash dressing should therefore be included in the preparation of the land for planting. If a dressing of kainit has not already been applied, 3 cwt. per acre of sulphate or muriate of potash should be applied now.

In older countries extensive experiments have been carried out to ascertain the most profitable planting distances, and local experiences endorse most of their conclusions on this point : 18 in. between plants and 5 ft. or 6 ft. between rows—the wider space in the richer soil—is usually the optimum spacing for commercial crops. In the homestead garden a double row may be planted, 18 in. between plants, and the two rows making the double. If more is required, there should be an interval of 5 ft. before planting a further double row. Asparagus plants are set deep. The usual method is to plough out a furrow 10 in. deep, place the plants in position, and cover firmly with about 2 in. of soil, the remainder of the filling being made during the summer during subsequent cultivation while the plants are growing. The ultimate covering is about 8 in., or rather less if the land is inclined to be heavy. No cutting is done the first season after planting, but at the second spring growth a short cutting season of two weeks is done if good progress has been made.

Where asparagus plants are required for planting next year seeds of a good strain should be sown now so that a long season of growth will be obtained to enable sturdy plants to be produced. As with other seed-beds, it is important that weed-seeds near the surface should be germinated and destroyed before sowing, thus obtaining a clean seed-bed. To hasten germination asparagus-seed is soaked in hot water, about 85° to 90° F., for a period up to four or five days, the surface moisture is then dried off, and the seed sown at once. The sowing is made sufficiently thin to produce good plants at intervals of about 3 in. or 4 in.—a depth of 2 in. to 3 in. and 24 in. to 30 in. between rows is usually most suitable.

Treatment of Soil.

The asparagus crop is partial to an alkaline soil condition, and established plantations, unless given generous treatment during the summer immediately after the cutting season has finished, should now be given 6 cwt. basic super phosphate and 2 cwt. sulphate or muriate of potash per acre, and such prepared farm manure as may be necessary to maintain the supply of humus in the soil. In any case, early in the month of September a dressing of nitrate of soda 2 cwt. per acre should be applied and repeated at monthly intervals as may be necessary. The present dressing is broadcasted and disked in both ways and the land harrowed down—further cultivation being done between the rows as may be required.

Sooner or later during the month of August all of the early crops, including turnips, potatoes, globe beet, carrots, and peas, may be sown ; main crop parsnips, onions, artichokes, cabbage, cauliflower, lettuce, and parsley may also be sown. Towards the end of the month kumaras are bedded down on a hot-bed, and celery, melons, cucumbers, and half-hardy crops of most kinds are sown with a view to producing sturdy plants for setting outside in about two months' time, when hard frosts have about finished for the season.

In the larger establishments and in the colder districts the hot-bed often takes the form of a low, gable-roofed glasshouse, 12 ft. to 14 ft. wide, heated by means of hot water carried round the interior in 4 in. pipes, or by means of an electric cable bedded in sand on the bench. In smaller gardens the hot-bed is a stack of fermenting stable manure 2 ft. or 3 ft. high and sufficiently wide to have a margin of about a foot when a glass frame is placed on top. In warm districts less manure is necessary to maintain the desired temperature, which is about 55° to 60° at night. The preparation of the stable manure will take about two or three weeks to bring it to the desired state of fermentation. More care is generally necessary in carrying out this operation. It is important that the material should be moist, and light sprinkling should be done when turning it, as is necessary, to maintain this condition ; at the same time, it should not be exposed to heavy rain during treatment. Where stable manure is scarce lawn mowings and fallen leaves may be mixed in to assist in making up the desired quantity. The desired temperatures are more readily obtained in the hot-bed if it is made in a well-drained, sunny, sheltered spot, also when the frame is well built to exclude cold draughts and in cold wet weather it is well covered up at night. The precaution which is most important is to air the plants by adjusting the sash-lights, especially in the early morning on fine days. There is no doubt the most fertile cause of disease amongst these crops is just the neglect of this attention. Much water will not be required at this stage, but what is given should be tepid.

Parsnips and other mature roots in the ground towards the end of August should be lifted before a second growth commences and stored in a cool place.

Small and Sundry Fruits.

The emphasis laid on the subject of ventilation of the tomato crop under glass during the period of October onwards has no application at the present time when the young plants have just been, or are about to be, planted out. There is no comparison between the two sets of conditions. The emphasis on generous ventilation is confined strictly to the summer period. The subject of ventilation requires much consideration and attention during the changeable weather of springtime in the unheated glasshouse to bring the plants along steadily without a check from a cold snap or being forced in high temperatures during a warm interval. Attention at this period is probably the most important factor in securing a good crop, and it must be given promptly so soon as any serious change in weather temperatures takes place.

For planting outside towards the end of October, and later, the tomato plants left over at the present time are unsuitable, as they will become stale and somewhat stunted. Sowings should be made at intervals from August onward to provide fresh plants for the outside crops, as steady growth without a check is indispensable for the best results. In this connection seed-strain, it should be remembered, is of the greatest importance. Vigour and health, as well as type, lie to a great extent in the strain of seed which is sown. For commercial cropping every care must be taken to obtain the most suitable.

Chemical Spraying.

To obtain good crops of small fruit much can be done by sound, clean management, such as planting out healthy stock in fresh ground, also cutting out and burning old canes of raspberry, loganberry, &c., so soon as the crop is gathered. A certain amount of chemical spraying is also necessary, and that applied during early spring is probably of the greatest importance. For leaf-spot fungus (*Mycosphaerella fragariae*) attacking strawberry plants a 1-per-cent. Bordeaux spray—Bordeaux 4-4-40—should be applied during the month of August and repeated as necessary, which will be for some time in the more humid districts. During the summer period lime-sulphur solution, with a polysulphide content of 1 per cent., may be used—that is, one part of standard lime-sulphur concentrate to 150 parts water.

For cane-wilt fungus disease (*Leptosphaeria coniothyrium*), which is fairly common among raspberries, as well as other troubles of the kind, Bordeaux 5-4-50 is applied at bud movement and twice subsequently at about monthly intervals with Bordeaux 3-4-50.

Both gooseberry and currant bushes are affected with leaf-spot fungus disease (*Mycosphaerella grossulariae*). Where this occurs a spring application of Bordeaux 5-4-50 is desirable, which may be followed with advantage by an autumn application at the same dilution.

Probably the most serious disease of the passion-vine is the brown-spot found on leaves and fruit, also on leading growth, which may eventually be cinctured and cause long sections to die. This brown-spot, or die-back, disease is caused by a fungus which has been identified as *Gloeosporium fructiginum*. The best control is obtained by pruning the vines with secateurs so soon as hard frosts are over for the spring, and spraying with Bordeaux 6-5-50 just before blossoming, and repeating it at intervals as required at a strength of 3-5-50. The trouble is most acute during a wet growing season.

The Homestead Garden.

During recent years heavy losses of crop have been experienced because they have been exposed at critical periods to high winds accompanied by heavy rain. Live-stock in cold, open country has also suffered severely in winter, while in summer the absence of any shade is a discomfort to them, which is almost as serious. These losses can only be avoided by planting shelter-trees, which to be effective must be carefully selected and planted after giving full consideration to the past experience of the kind in the locality. Fencing-posts and firewood are also important considerations in the back country, and it is most convenient to grow them on the spot where they are required, instead of hauling them long distances. The months of August and September complete the planting season for trees of this kind, and to avoid the loss of another growing season work of that class should be carried out without delay in fine weather.

Such fruit and ornamental trees and shrubs as may be required about the homestead should also be planted now. Past experience has probably indicated the classes most suitable to the locality, and it is often best, in the main, to confine the selection to further species and varieties of those classes that have proved most suitable, thus providing a pleasing diversity which will flourish with a minimum of attention.

Seeds of hardy annuals may now be sown outside and half-hardy annuals in frames for planting out when spring frosts are over.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

" THISTLE MOUTH " IN LAMBS.

A. W. M., Norsewood :—

What is suitable treatment or cure for the so-called disease " thistle mouth " commonly found on lambs at this time of the year ? If not treated would the disease disappear eventually ?

The Live-stock Division :—

The use of the term " thistle mouth " in the case of lambs apparently is a description of an ulcerative condition affecting the lips and nose of lambs resulting in the formation of thick crusts on these areas. The treatment consists of the removal of the affected lambs and their segregation on a pasture of fresh young feed, if this is available. The application of a weak antiseptic lotion such as a 1-per-cent. solution of lysol in water will assist in allaying the irritation to enable healing to take place. In cases where there is much " proud flesh " an astringent lotion of copper sulphate in water, using about 1¼ oz. of bluestone per gallon of water, assists in the removal of the thick crusts and facilitates healing. Mild cases frequently recover when suitable pasture can be obtained and the irritating factor removed. It is, however, advisable to carry out some treatment as suggested. The selected lotion may be repeated after a few days, when healing quickly occurs.

TREATING FOOT-ROT IN SHEEP.

R. J. D., Canvastown :—

What is the best treatment for the cure of foot-rot in sheep ? A few sheep affected have been treated by paring the hooves and then treating the affected parts first with spirits of salts and finally with an ointment composed of equal quantities of stockholm tar and powdered bluestone.

The Live-stock Division :—

The treatment of foot-rot in sheep by means of trimming the hooves of affected animals and then applying a foot-rot ointment as outlined should prove satisfactory. The application of spirits of salts can be recommended only in certain cases, and it appears in your case that the use of spirits of salts followed by an application of the strong bluestone tar ointment may prove too caustic in its action. It is therefore recommended that a weaker tar ointment be applied after the hooves have been trimmed, and that you discontinue the use of the spirits of salts in the meantime. It is advisable to use an ointment composed of 1 part of bluestone to 3 parts of tar. The best drained paddocks should be selected for the affected animals until recovery takes place

CARE NEEDED IN FEEDING LUPIN-SEED.

T. W. H., Hororata :—

Could blue-lupin seed be used for feeding to pigs ? Would crushing lessen their toxic effect ? Could the seed be used as a winter ration for in-lamb ewes together with hay or straw ?

The Live-stock Division :—

Blue-lupin seed is generally accepted as being less toxic than seed from the yellow variety. At the same time, it is necessary to recognize that a chronic disease known as lupinosis is known to follow the ingestion of any variety of lupin, whether plant or seed, the yellow lupin being considered to be the most toxic. Heavy mortalities among horses, cattle, sheep, and pigs have been attributed to the use of lupins On account of the greater susceptibility of pigs to any foodstuff containing toxic matter, one cannot recommend the use of blue-lupin seed for this class of animal. The seeds are more harmful than the plant. Crushing will not lessen the toxic effect of lupin-seeds. The seeds can be fed to animals if they are well soaked and washed in water and the toxic principles leached out. A strictly limited amount of not more than ¼ lb. per head per day of unleached ground-up seeds may be fed to sheep when mixed with cut fodder. Up to 1 lb. per head per day may be given when the seeds are thoroughly leached On account of the toxic alkaloids, one cannot recommend the use of the seeds for in-lamb ewes; in fact, it is advisable to limit any use that may be made of the seed to non-breeding stock.

SOYA BEANS.

J. B. R., Remuera :—

Can you tell me if there is any variety of soya bean that is suitable for growing as a vegetable in a small garden ?

Also what is the edible portion ?

Does one boil the green pods after the style of French beans, or does one thresh the ripe beans out of the pods and cook them like haricot beans ?

What is soya-bean flour ? Can one make it from the ripe beans by grinding, say, in a coffee-mill ?

Horticulture Division :—

The soya bean is not usually sold at present among the seeds for the small garden. The Sanitarium Health Food Co., have a variety which it is stated has been grown satisfactorily in the warmer parts of the country. The beans are cooked as haricots ; they require to be soaked overnight and boiled for three hours, changing the water twice meanwhile. Better still, they may be boiled in a pressure cooker in about half an hour.

Soya-bean flour is one of the many products of these seeds. At present supplies are imported, and it is doubtful if simply drying and grinding the seeds would give a satisfactory product.

WEATHER RECORDS: JUNE, 1937.

Dominion Meteorological Office.

NOTES FOR JUNE.

General.—June was a very cold month, and, in spite of the fact that over much of the country the rainfall was below normal, it was also a damp one in most districts. Except in places especially exposed to the southerlies or south-easterlies which prevailed throughout most of the month, winds were not strong. There was, consequently, little drying, and the soil is almost everywhere saturated with moisture. Work on the land has been difficult, and a smaller area than usual has been sown in wheat. After the first few days growth of pasture practically ceased, and the older material has deteriorated. Hand feeding has been resorted to to a considerable extent, but so far there is no shortage of feed. Stock are, on the whole, doing well, with the exception of hoggets, for which it has been a poor season. The milk-yield has fallen away rapidly. Vegetation in general does not appear to have suffered, and in many places flowering plants have done rather well

Rainfall. —Rainfall was much above normal in the Auckland and Coromandel Peninsulas. Parts of North Auckland had double the average, and some severe flooding occurred there towards the end of the month. There were large deficits in most of Marlborough, Nelson, Westland, the interior of South Canterbury and Otago, and in the interior of the North Island. On the west coast and in the southern interior of the South Island it was a particularly fine month, with few wet days.

Temperatures.—Temperatures were everywhere below normal.

Sunshine.—Sunshine was much above normal on the west coast of the South Island and somewhat above, also, in Nelson and Blenheim and the southern portion of the South Island At Waipoua, on the western side of the Auckland Peninsula, more than average was recorded.

Pressure Systems.—At the beginning of the month a cyclonic depression was located over the western Tasman Sea, while pressure was low to the east of New Zealand This depression moved in a south-easterly direction till it reached southern New Zealand on the 4th as a deep westerly depression. Strong northerlies preceded it, there being gales in Cook Strait on the 4th. There was general rain with many heavy falls On the 5th came a change to cold, strong southerlies, with widespread snowfalls. Hail and thunder also occurred in many places. On the 4th a small tornado did some local damage at Uruti, in Taranaki.

From this time onwards southerly or south-easterly winds and cold weather were persistent.

From the 7th to the 10th shallow depressions were passing to the north of New Zealand, and on the 12th a westerly depression affected the southern portion of the South Island.

From the 16th to the 18th a cyclonic depression crossed the central part of the Dominion, bringing much rain to the North Island, with some strong north-east to easterly winds in the Auckland Province.

On the 20th a cyclone developed off the coast of New South Wales. This became very deep and extensive and moved eastward very slowly. It crossed New Zealand on the night of the 24th. Very rough weather was associated with its passage across the Tasman. In New Zealand it caused strong easterly winds as it approached, and was followed by strong south-easterlies. These brought very cold weather and further extensive snowfalls. Several secondaries followed the main cyclone, moving from the north-west past the North Island. There was much rain in North Auckland and between Hawke's Bay and East Cape, with flooding in places, especially about Whangarei. The South Island, except for snow on the 24th, was comparatively little affected.

RAINFALLS FOR JUNE, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Fall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	In.		In.	In.	In.	In.
Kaitaia	7·14	13	2·35	6·59	35·90	28·16
Russell	20·43	15	6·15	6·67	63·72	30·63
Whangarei	18·40	21	6·27	6·54	51·76	31·60
Auckland	7·25	22	1·59	5·44	25·99	24·28
Hamilton	..	..	..	5·11	..	23·90
Rotorua	2·65	15	0·67	5·25	28·44	26·87
Kawhia	..	..	..	5·72	..	25·54
New Plymouth ..	5·92	16	1·22	5·95	32·08	28·54
Riversdale, Inglewood ..	5·98	14	1·32	10·27	51·59	48·65
Whangamomona ..	..	..	..	7·89	..	35·70
Hawera	3·17	13	1·00	4·41	22·74	21·39
Tairua	10·49	16	2·25	6·97	30·71	33·56
Tauranga	4·83	18	1·06	5·35	30·11	26·88
Maraehako Station, Opotiki	2·91	9	1·76	5·66	31·64	27·79
Gisborne	5·21	15	1·70	4·90	19·08	24·91
Taupo	2·11	14	0·44	4·56	18·31	21·36
Napier	2·98	14	1·06	2·92	11·57	16·08
Hastings	3·67	14	1·15	3·07	9·41	16·63
Taihape	2·84	20	0·52	3·38	17·66	17·81
Masterton	3·74	20	0·78	3·59	16·78	18·77
Patea	3·41	15	1·03	4·24	24·33	21·40
Wanganui	1·73	9	0·62	3·37	19·09	17·70
Foxton	0·99	10	0·33	3·39	13·12	15·27
Wellington	3·33	21	0·78	4·31	18·66	20·89
South Island.						
Westport	..	..	..	8·85	..	46·50
Greymouth	3·96	12	1·22	8·80	56·10	49·56
Hokitika	3·97	11	1·18	9·22	59·62	55·09
Ross	5·03	7	1·60	8·73	71·64	62·77
Arthur's Pass ..	..	..	..	10·53	..	75·94
Okuru, South Westland	1·60	2	1·00	10·72	78·62	72·04
Collingwood	3·51	12	1·39	10·30	47·47	45·08
Nelson	1·25	6	0·75	3·51	18·61	18·32
Spring Creek, Blenheim	1·38	9	0·36	2·94	14·77	14·47
Seddon	1·84	10	0·59	2·09	13·30	12·32
Hanmer Springs ..	5·09	17	1·23	3·39	17·75	21·77
Highfield	4·10	13	0·95	2·47	12·29	16·74
Gore Bay	5·78	10	1·76	2·69	18·92	15·87
Christchurch	2·12	19	0·50	2·53	12·80	12·63
Timaru	0·96	7	0·39	1·75	13·23	11·14
Lambrook Station, Fairlie	0·80	6	0·25	1·86	11·61	11·98
Benmore Station, Clearburn	0·93	8	0·33	1·81	16·27	12·80
Oamaru	0·74	10	0·27	1·98	9·93	10·98
Queenstown	1·10	8	0·54	2·22	17·28	15·35
Clyde	0·13	3	0·07	0·92	10·13	7·76
Dunedin	3·25	15	0·88	3·14	26·57	18·08
Wendon	2·06	12	0·79	2·59	27·70	15·48
Balclutha	2·24	18	0·37	1·99	21·72	12·71
Invercargill	2·90	20	0·75	3·64	24·83	23·31
Puysegur Point ..	6·02	20	1·52	6·59	48·30	42·26
Half-moon Bay ..	..	..	..	4·91	..	29·13

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PIG INDUSTRY.

BREEDING AND FEEDING FOR THE MARKET

(Continued.)

M. J. SCOTT, Superintendent of the Pig Industry

A COMBINED herd-book is issued under the auspices of the New Zealand Pig-Breeders' Association. One volume is issued each year, and about eighteen volumes have been issued to date. There are about 360 registered breeders in New Zealand, of whom about 190 breed Tamworths, about 100 Berkshires, forty Large Whites, and thirty Large Blacks, less than ten Middle Whites, and one or two Duroc Jerseys. From these breeds all sorts of crossbred pigs are produced and offered for sale on the English market in competition with a single distinctive line offered by other competitors for the trade. A moment's reflection will make it obvious that by gratifying the valueless idiosyncrasies of individual breeders we have done ourselves a great national disservice, without any individual actually getting any especial reward beyond his own satisfaction.

It should be possible without doing any injury to individuals to eliminate all but two breeds in the course of a few years, and from those remaining to produce a half-bred pig that would supply both the porker and baconer trade. It seems an easier problem to select and multiply good Tamworths and Berkshires, now widely distributed, than to improve our Large Whites or the conditions under which these are kept till we can be sure they will be satisfactory. In the end one or other of these plans must be followed if pigs continue to develop and the industry expands as it is capable of doing.

USE PURE-BRED STOCK.

As the pig industry has developed, so the importance of quality has increased. The English trade classes pigs into the following groups :—

	Approximate Dead Weights
Porkers	61 to 80 lb.
Porkets	81 to 100 lb.
Cutters	101 to 120 lb
Baconers	121 to 170 lb.

In addition, pigs of all weights below 60 lb. and all weights above 170 lb. are marketed in some part of England, but as a rule the 61 lb. to 80 lb. class is most popular, and gets a small premium. The next most popular is the bacon class, 130 lb. to 170 lb. General satisfaction is expressed at the quality of our porkers, but our baconers are either too short and light or too fat and heavy.

Generally they lack uniformity, and this can be most easily acquired by using standard types of breeding-stock. These standard types are fixed with greater certainty in purebred strains than they are in crossbred pigs, and, whatever the advantages of crossbred sows for breeding purposes, they are outweighed by the national good that would arise from marketing uniform pigs.

THE BOAR.

The importance of using a good boar can never be over emphasized. Pigs provide only carcass: there are neither wool nor milk factors to confuse the issue. All that is wanted is a good carcass, produced by quick-growing, efficient feed-converters. Pedigree breeders produce as many boars as sows each year, and since only a few boars are wanted there must be a very rigorous selection going on. Get a boar whose parents have proved their prolificacy, rapidity of growth, and ability to use feed efficiently. Up to the present a buyer has had to depend upon the integrity of the pedigree breeder, and while there are many who are satisfied with this arrangement, there are many who demand the testing of pedigree pigs, and a national testing service was instituted last year. This will expand and develop, and before long it should be possible to provide boars of proved ability. This should establish better relations between buyers and sellers, and encourage the wider use of pedigree stock for commercial pig-production. From a national point of view purebred boars should be used in order to produce uniform pigs. By this means we can most quickly establish that uniformity that is the hall-mark of quality.

Whatever the boar, he must be vigorous, active, and masculine, without being unduly coarse. Width between the legs, flat bone, nice-quality silky hair, alert carriage, standing well up on the toes, freedom from wrinkles, and evenness of temper are some of the external attributes of the good boar. He should have twelve to fourteen rudimentary teats evenly spaced and well forward on to the breast. Boars should be kept in a paddock by themselves, and fed as carefully as any other animal. If the boar is run with the sows it is impossible to keep farrowing dates, and, as a result, some sows must be abused. A boar may be used for a few sows at six months old, but he is given a better chance to develop and grow if he is not used until he is eight or even ten months old. It is advisable to detusk all boars, an operation that is quickly and easily done by tying the boar to a post or putting him in a bail (useful for ringing pigs) and cutting out the tusks with a wood-chisel.

THE SOW.

It goes without saying that if efforts are spent in getting a good boar equal care must be given to the choice of a sow. As a rule the boar stamps his general outward appearance on his progeny, but it is claimed that the sow transmits stamina, ability to grow, and other non-visible health characters. Sows are often bought as weaners, and at that stage the only means of judging them is by their parents—usually their mother. A sow should have at least twelve to fourteen well-placed teats extending well on to the breast, be of quiet disposition, with plenty of length, good quarters, and well-sprung ribs. The thick, short-necked, narrow, or leggy or heavy-shouldered sow is not wanted. Never use sows or boars out of litters that show any sign of rupture or other irregularity of testicle development in the boars of the litter. Rupture is an inherited weakness that must be present in both parents before it comes out in the offspring. Keep it out of breeding-stock by avoiding pigs from litters that show any sign of it.

A sow may be mated at six to seven months if particularly well grown, but such a sow will remain small till about the fourth litter. If well fed she will give just as good litters as well-grown sows can, but she will go to pieces on a poor feed-supply quicker than a matured sow. It is more general to wait till sows are eight months old—some let them go to ten months—before serving them. They produce bigger litters each time up to about the fourth or fifth, but at weaning the maiden sow may have as many and as good pigs as the older sow. As a rule the younger the sow the more careful she is to rear all the pigs born, and at about the sixth litter the element of carelessness has become so pronounced that from this stage onward the number of pigs reared per litter gradually falls off. Records show the following results for a number of sows :—

—	First Litter.	Second Litter	Third Litter.	Fourth Litter	Fifth Litter.	Sixth Litter	Seventh Litter.	Eighth Litter.	Ninth Litter	Tenth Litter.
Average number born	9	10	11	12	13	14	14	14	14	14
Average number reared	6·8	7·2	7·8	8·2	8·0	7·0	6·0	5·0	5·0	5·0
Average weight per piglet (lb.)	35·0	35·5	36·0	36·5	37·0	37·0	40·0	40·0	40·0	40·0

RENEWAL OF SOWS.

Although there are many good litters produced from sows that are over four years old, it pays to renew most sows after the sixth litter—*i.e.*, after they are three and a half years old. They have to fail sometime, and collected information shows that on the average they begin to fail after the sixth litter. It is possible to keep each sow until she actually does fail, but, since sow-renewal can be arranged so that it does not cost a great deal, it is safer to keep young sows. Kindly treatment of sows is as valuable as the best of feed and shelter, and costs nothing. Where sows are abused either by man or by circumstances, there one finds most trouble from pigs being eaten at birth and from being overlain. Being in harmony with her surroundings makes a sow profitable, and for this reason it is worth while confining a sow to her farrowing quarters fully three weeks before she farrows. She has time to adjust herself to possible changes of food, or temperature, or shelter, or outlook, or noise, or any of the things that may upset an overburdened matron. To guard against rough weather during the first two or three days after farrowing, it is probably safer to have the sow shut up for farrowing. Farrowing comes but once a year (or is it twice ?), and dead pigs show no profit, however carefully plans have been made for the other 364 days of the year !

Sows repay the owner for careful attention during the time they are suckling a litter, and just prior to this. Every one who has owned a sow knows what this means, and it is within most people's compass to provide that attention when they realize that it is worth while doing so.

CARE OF THE LITTER.

The litter lives on the sow's milk till they are about three weeks old. Just before this age is reached it is advisable to start the youngsters feeding on their own account. This is done with whole cow's milk most easily, but they can be encouraged to take any feed, and if they do this from their own trough behind a creep that keeps the sow away they are more likely to keep healthy and to feed better. At about three weeks old the litter often goes off a little, either through scours or some other infection, or if the litter is big, through insufficient to eat. Timely attention that tides them over this period gives them a better chance. A sod of fresh soil put in the pen daily often keeps them healthy, perhaps because of the iron or other element they get out of the soil, or perhaps because the earth performs some detoxicating action in their digestive system. Three weeks is a good time to castrate, the pigs are easily handled, are not so active as to do themselves any injury by racing round or fighting or getting into the dirt. Most of the rejects at the works due to faulty castration would be avoided if pigs were castrated earlier.

It has been observed that a further check often takes place at five weeks. This usually happens if the pigs are not by this time eating out of the troughs fairly readily. Weaning takes place as early as six and as late as ten weeks after farrowing. It is best to remove the sow and to keep on feeding the weaners for another month so as to keep them growing as fast as they will. There is only one way to do this. Give them as much as they will eat of good pig-food—fibrous foods are not suitable at this age—feed them regularly and cleanly, and keep them warm and dry. The sow comes on heat within three to five days after weaning, and should be put to the boar as late in the heat as possible. If she is missed at this stage, she is often difficult to get in pig later, because no automatic flushing occurs except at weaning-time. If she has been missed after weaning, shut the sow up and feed her well till she does come on heat.

POULTRY-FEEDING EXPERIMENTS, 1936-37.

W. L. JOURDAIN, Poultry Overseer, Government Poultry Farm, Wallaceville.

AN experiment was carried out at the Wallaceville Poultry Station over the ten months from 1st April, 1936, to 31st January, 1937, for the purpose of ascertaining the respective merits for egg-production, of the following five methods of feeding: soaked wheat; soaked barley; bran and pollard mash; bran, pollard, and wheatmeal mash; and dry mash.

Two hundred pullets were used for the test, and were divided into five different pens of forty birds each as uniformly as possible. The houses were also of the same size and type throughout.

Feeding was carried out as follows: The birds in pens 1 and 2 each received two meals of soaked grain per day, one about 7 a.m. and the other about 4 p.m.; those in pens 3 and 4 received one mash meal per day about 7 a.m. and one grain meal per day about 4 p.m.; and those in pen 5 had the dry mash before them all the time, and in addition received a grain meal about 4 p.m. In addition approximately 2 lb. of oats were fed to each pen in the litter every midday as a scratch grain to induce them to "work," and after they had been given their last meal at about 4 p.m. they were all given green food in the form of young green oats and silver beet. Oyster-shell and gravel grit was also supplied *ad lib.*

Pen 1. Soaked Wheat.

The method of feeding adopted with this pen was as follows:—

The amount of wheat required for each meal was first soaked in water for twenty-four hours. The water in which the wheat was soaked for each meal had approximately 1 per cent. of salt dissolved in it. For the morning meal the soaked wheat was dried off with the bran mixture (see Table 1), and for the evening feed it was dried off with plain bran and green food; the amount of green food was approximately one-third of the total mixture of bran, wheat, and green food.

The amounts of food prepared and stored each time was as follows:—

Table 1.

Bran Mixture	Bran	Wheat.
17 lb bran 11 lb. meat-meal 2 lb linseed-meal 30 lb	30 lb	100 lb

The amount of meat-meal averaged approximately 10 per cent by measure of the wheat

The birds in this pen, in common with pen 2, were transferred from the normal feeding—mash in the morning and grain in the evening—to the soaked wheat at morning and evening within a fortnight. The result of this drastic change was to put practically all the birds in these pens into a full moult within a month.

Several times it was noticed that the birds seemed to get tired of the soaked wheat and then in a few days they returned to their usual amount of feed. These birds did not consume as great an amount of soaked wheat as the amounts of foods consumed by the other pens in the test, with the exception of those on soaked barley. Never at any time did the pen 1 birds lay as well as the birds being fed on mash and grain diets.

Pen 2. Soaked Barley.

The method of feeding adopted with this pen was exactly the same as for pen 1 except that barley was substituted for wheat in the ration, which was as follows:

Table 2

Bran Mixture	Bran	Barley
17 lb. bran. 11 lb. meat-meal. 2 lb. linseed-meal. 30 lb.	30 lb.	100 lb

The amount of meat-meal averaged approximately 10 per cent. by measure of the barley.

Comparing this pen with pen 1 very little difference was seen as far as the amount of food consumed was concerned, there being 147 lb. less barley (see Table 6). Of course the difference between the prices of wheat and barley would give a further advantage still in the feeding-costs, but the smaller number of eggs from the barley pen would to a great extent offset that advantage.

There was a fairly heavy mortality with both pen 1 and pen 2. The majority of deaths in both these pens was due to vent-picking. To try to prevent this the amount of meat-meal was reduced considerably later in the experiment.

These birds never seemed to tire of the ration of soaked barley, although they never at any time ate a very great deal at a meal, appearing to be satisfied with less bulk than the birds on soaked wheat.

The birds in this pen, as mentioned before, went off into a heavy moult just after the commencement of the test, thereby affecting the egg-production considerably.

Pen 3. Bran and Pollard Mash.

This pen received only bran, pollard, and meat-meal in their mash, the mixtures for the mash and grain meals being as follows:—

Table 3.

Mash Mixture.	Grain Mixture.
32 lb. pollard.	60 lb. wheat.
9 lb. bran.	20 lb maize
9 lb. meat-meal	20 lb barley.
1 lb. linseed-meal.	—
—	100 lb.
51 lb.	

The meat-meal was approximately 10 per cent. by measure

The birds on this ration were always in the best of health, and always hungry and ready for their food. This pen ate more than any of the other pens at the commencement of the experiment and continued to do so until the finish.

The egg-production of this pen never dropped to the same extent as the two pens on the soaked grains, probably because there was not such a radical change in the system of feeding, and therefore there were not so many birds which dropped into a moult.

Pen 4. Bran, Pollard, and Wheatmeal Mash.

This pen was given bran, pollard, wheatmeal, and meat-meal in their morning mash and mixed grain in the evening as follows:—

Table 4.

Mash Mixture.	Grain Mixture.
18 lb. bran.	60 lb. wheat.
32 lb. wheatmeal.	20 lb. maize.
14 lb. pollard.	20 lb. barley.
13 lb. meat-meal.	—
—	100 lb.
77 lb.	

The meat-meal was approximately 10 per cent. by measure.

The mash-mixture for this pen was the standard mash used at this Station, and this pen was therefore the control pen for the whole experiment.

One bird in this pen died through digestive disorder, one with abdominal dropsy, two with ovarian trouble, and the other two were vent-picked.

These birds never went into a moult and never dropped in egg-production as much as any of the other pens in the experiment. It was naturally expected that they would not do so, as there had been no change in their diet or their treatment. The only reason why the birds in either this pen or the dry-mash pen (pen 5) should go into a moult would be that they had perhaps commenced to lay very early in the season. However, they did not lay as many as pen 3 even though pen 3 dropped more in production shortly after the test commenced.

Pen 5. Dry Mash.

This pen of pullets had been reared on dry mash since they were day-old chicks, and there had been no change in their diet since they were three months old. The dry mash with which they were fed was made up as follows:—

Table 5

Mash Mixture.	Grain
50 lb maize-meal 16 lb. bran. 16 lb. pollard 4 lb meat-meal 4 lb. milk-powder. 4 lb linseed-meal 2 lb bonedust. ½ lb salt 96½ lb.	Wheat

After these birds commenced to lay (which was before the experiment started) they went right ahead, with the exception of a few weeks just after the beginning of the experiment, when they seemed to be at a standstill. However, after they got over that period they went ahead rapidly and laid well, finishing about 700 eggs ahead of the next highest pen.

Even though they had the dry mash before them all the time, they still gave every indication that they relished their grain feed at 4 p.m.

The following tables give—

(1) The costs and the amounts of food consumed (Table 6):

(2) The number of eggs laid and the amount received for them (Table 7).

Table 6.—Quantities and Costs of Food consumed

Foodstuff.	Average Price.	Pen 1.		Pen 2		Pen 3		Pen 4.		Pen 5.	
		Quantity used.	Cost.	Quantity used	Cost	Quantity used	Cost.	Quantity used.	Cost.	Quantity used.	Cost
		Lb	£ s d	Lb	£ s d	Lb	£ s d	Lb.	£ s d	Lb	£ s d
Wheat ..	5s. 9·25d. per bushel	1,965	9 9 0	..	..	1,020	4 18 1	810	3 17 11	1,182	5 13 8
Barley ..	3s. 4·83d. per bushel	..	..	1,818	6 3 8	340	1 3 2	270	0 18 4	..	..
Oats	4s. per bushel ..	614	3 1 5	614	3 1 5	614	3 1 5	614	3 1 5	614	3 1 5
Maize.. ..	6s. 10·91d per bushel	..	..	..	..	340	2 1 11	270	1 13 4	..	..
Bran	£6 5s. 8d. per ton ..	375	1 3 7	353	1 2 2	214	0 13 5	249	0 15 8	254	0 15 11
Pollard ..	£7 3s. 8d. per ton ..	..	..	..	..	763	2 14 10	192	0 13 10	253	0 18 2
Meat-meal ..	£7 6s. 8d. per ton ..	125	0 9 2	107	0 7 10	234	0 17 2	180	0 13 2	65	0 4 9
Wheatmeal ..	£9 15s. per ton ..	..	..	..	..	..	..	442	2 3 1	..	..
Maize-meal ..	£12 15s. per ton ..	..	..	..	..	..	..	..	..	792	5 1 0
Linseed-meal ..	15s. per 100 lb. ..	23	0 3 5	21	0 3 2	24	0 3 7	..	..	63	0 9 5
Oyster-shell grit	4s. 6d. per 100 lb. ..	100	0 4 6	100	0 4 6	131	0 5 11	106	0 4 9	131	0 5 11
Milk-powder ..	£2 9s. per cwt. ..	..	..	..	..	..	..	..	..	63	1 7 7
Bonedust ..	9s. 6d. per cwt. ..	..	..	..	..	..	..	..	..	32	0 2 9
Salt	1d. per lb.	9½	0 0 10	9½	0 0 10	..	..	..	..	8	0 0 8
Total costs	..	..	14 11 11	..	11 3 7	..	15 19 6	..	14 1 6	..	18 1 3

Table 7.—Eggs laid and Amount received in respect of each Pen

Month	Average Price per Dozen	Pen 1		Pen 2		Pen 3		Pen 4		Pen 5	
		Dozen.	Value	Dozen	Value	Dozen	Value	Dozen	Value	Dozen	Value
			£ s d		£ s d		£ s d		£ s d		£ s d
April	2s 3·8d. ..	$20\frac{7}{12}$	2 7 8	$14\frac{8}{12}$	1 14 0	$26\frac{3}{12}$	3 0 10	$31\frac{6}{12}$	3 13 0	56	6 9 9
May	2s 4·5d ..	$13\frac{7}{12}$	1 12 3	$12\frac{4}{12}$	1 9 4	$19\frac{6}{12}$	2 6 4	$22\frac{8}{12}$	2 13 10	$31\frac{10}{12}$	3 15 7
June	1s. 10·8d ..	$23\frac{8}{12}$	2 5 0	$26\frac{2}{12}$	2 9 8	$24\frac{11}{12}$	2 7 4	$27\frac{6}{12}$	2 12 3	$33\frac{11}{12}$	3 4 5
July	1s 4·5d ..	$32\frac{7}{12}$	2 4 10	$47\frac{3}{12}$	3 4 11	$51\frac{4}{12}$	3 10 7	$39\frac{2}{12}$	2 13 10	$49\frac{5}{12}$	3 7 11
August	1s 3·8d ..	$49\frac{4}{12}$	3 5 0	$48\frac{9}{12}$	3 4 2	$62\frac{4}{12}$	4 2 1	$57\frac{7}{12}$	3 15 10	$62\frac{11}{12}$	4 2 10
September	1s 0·75d. ..	$59\frac{1}{12}$	3 2 9	$46\frac{10}{12}$	2 9 9	$64\frac{1}{12}$	3 8 1	61	3 4 10	$67\frac{9}{12}$	3 12 0
October	1s 2·125d	$56\frac{11}{12}$	3 7 0	50	2 18 10	$68\frac{3}{12}$	4 0 4	$59\frac{3}{12}$	3 9 9	$69\frac{9}{12}$	4 2 1
November	1s. 3·4d ..	$52\frac{8}{12}$	3 7 7	$48\frac{5}{12}$	3 2 2	$64\frac{4}{12}$	4 2 6	$53\frac{4}{12}$	3 8 5	$63\frac{4}{12}$	4 1 4
December	1s 5·5d. ..	$46\frac{7}{12}$	3 7 11	$34\frac{11}{12}$	2 10 11	56	4 1 8	$49\frac{6}{12}$	3 12 2	$57\frac{11}{12}$	4 4 6
January	1s 6·5d. ..	40	3 0 10	$34\frac{6}{12}$	2 12 6	$49\frac{1}{12}$	3 14 8	$52\frac{5}{12}$	3 19 9	$51\frac{1}{12}$	3 17 8
Totals	..	395	28 0 10	$363\frac{10}{12}$	25 16 3	$486\frac{1}{12}$	34 14 5	$453\frac{11}{12}$	33 3 8	$543\frac{11}{12}$	40 18 1

Table 8.—Net Profit over Cost of Foods.

Pen No.	Number of Birds at Start of Test.	Number of Weeks	Approximate Average Number of Birds during Test.	Total Number of Eggs Sold (in Dozens)	Amount received for Eggs			Total Cost of Food.			Differences.		
					£	s.	d.	£	s.	d.	£	s.	d.
1 ..	40	39½	37	395	28	0	10	14	11	11	13	8	11
2 ..	40	39½	35	303 10/12	25	16	3	11	3	7	14	12	8
3 ..	40	39½	39	486 1/12	34	14	5	15	19	6	18	14	11
4 ..	40	39½	36	453 11/12	33	3	8	14	1	6	19	2	2
5 ..	40	39½	38	543 11/12	40	18	1	18	1	3	22	16	10

SUMMARY.

The details given in the last table (Table 8) reveal the result of the experiment at a glance. It will be seen from this that the cost of food for pen 5 was considerably more than that of any of the other pens, costing £2 1s. 9d. more than the next highest. Against the higher cost, however, these birds laid more eggs than any other pen, thereby more than paying for the extra cost of feed. As will be seen, the two pens on soaked grains gave the poorest results in this test; but, considering that the majority of these birds went into a moult soon after the experiment commenced, it would not be fair to compare their results with those of pen 5.

Another point of interest is that the pullets in both pens 4 and 5 were sexed pullets—that is, sexed as day-old chicks—whereas the other pullets in pens 1, 2, and 3 were not sexed. The results of the test would therefore prove that sexing does not harm the pullet in any way as far as egg-production is concerned.

The results of this experiment is not taken as conclusive, and therefore a further experiment along the same lines is being carried out during 1937-38.

MULCHING OF CITRUS TREES.

SEVERAL growers in the Auckland District are paying more attention to mulching their citrus trees in order to get a greater supply of organic matter into the soil. This work has been going on for several years, and the advantage is now to be plainly seen, first in the dark-green foliage with a smooth surface, and secondly in the skin of the fruit itself, which is very smooth and clear.

In both instances where this is done the method is to have a separate field in which the grass or clovers are grown, and this is cut during the late summer, and the material placed around the trees well out to the spread of the branches. This material very soon decays and mingles freely with the soil, and by this means it is kept in a good mechanical condition such as the tree requires in order to flourish. A certain quantity of artificial manure is also used, but the quantities have been reduced by nearly half since the mulching has been carried out.

This practice may also be applied with other fruits where it is practicable, and material for mulching purposes can be obtained especially in those localities where the soils are deficient in organic matter.

WHEAT-VARIETY TRIALS.

OPERATIONS FOR SEASONS 1935-36 AND 1936-37.

J. W. Woodcock, Crop Experimentalist.

THE wheat-variety trials conducted by the Fields Division over the past two seasons have been mainly directed towards the testing-out in various districts of new varieties which are either foreign wheats introduced by, or crosses bred by, the Wheat Research Institute. In each experiment an endeavour is made to select a locality characteristic of the district. In testing out a new variety its characteristics are taken into account when selecting the localities for trials, as well as the ecological conditions of these localities, so that, taking all experiments of the variety, a wide range of ecological conditions is covered. Close collaboration is now maintained between the Institute and the Fields Division, not only in the general field trials, but also in the preliminary work which involves the final selection of some dozens of crossbred lines, and the institution of "ecological trials" in several districts is of some assistance to the geneticist, Dr. Frankel, in selecting those lines which show promise.

Varieties under Trial.

In the experiment under review either Solid Straw Tuscan or Cross 7 have been taken as the standard variety with which the others were compared. In most cases both the above were included.

Marquis.--Trials with this variety were confined to Marlborough, where it is popular and is apparently capable of giving satisfactory yields of high-quality grain.

Federation.--This variety has for some years past held an important position in Marlborough, although it is now gradually losing favour.

Jumbuck.--In view of its reputation in the North Island and the need of a satisfactory wheat for spring sowing in the South, the use of Jumbuck has increased in the South Island during recent years.

Nabawa and Ford.—The possibilities of these two Australian varieties, introduced by Mr. A. Grant, Waimate, for spring sowing, were investigated.

Tainui and Taiaroa.—Formerly named S 617 and S 668 respectively, these two varieties, originating from Portugal, were selected by the Wheat Research Institute from a number of imported lines. They have shown much promise as spring-sown wheats in small-scale trials in Otago, and also in large-scale trials at Morven and Lincoln College in the 1934-35 season. Tainui is one of the earliest maturing varieties known in New Zealand.

Lin Calel.—This is a well-known wheat from the Argentine, where it ranges amongst those with highest grain quality. In preliminary trials at the Pure Seed Station, Lincoln, it gave good results. It gives promise also of being a high-quality wheat, although, being a bearded variety, its appearance in the field is somewhat unattractive.

Bencubbin.—This variety from Western Australia is being grown in North Otago, and from reports obtained from farmers appears to prove satisfactory in that district.

Cross 31.—From the point of view of baking score and general agronomic characters the various lines of Cross 31 are similar to Solid Straw Tuscan. It was considered after preliminary trial, however, that the best lines would generally outyield Tuscan.

METHOD OF CONDUCTING EXPERIMENTS.

Most of the trials were laid down in blocks with eight to ten replications of each variety. In others a modification of the " Beaven half-drill strip " method was employed, each variety being compared with adjacent control plots. The results were mostly examined statistically by the analysis of variance or by " students " method, except in Marlborough, where no facilities are available for threshing plots separately. A standard rate of seeding of 2 bushels per acre for each variety was generally adopted, and 1 cwt. of superphosphate was sown with the seed. Harvesting was usually carried out when the later-ripening varieties were in fit condition, although under some circumstances earlier-maturing varieties were cut with a scythe before the remainder. At harvest samples of each variety were collected and sent to the Wheat Research Institute for milling and baking tests.

SUMMARY OF 1935-36 SEASON'S TRIALS.

Twelve trials were harvested in 1935-36, and the yields, together with remarks on the condition of varieties at harvest, are given in the tables and notes which follow :—

A. *Marlborough Trials.*

Varieties compared : S.S. Tuscan, Cross 7, Marquis, and Federation (soft).

(1) *M. Walsh, Omaka.*—Date sown : 12th June, 1935. Date harvested : 6th January, 1936.

When cut Federation appeared to be the heaviest yielder, but differences were small. Birds had attacked all varieties to some extent, and the Federation in particular. Birds were troublesome when the crop was in stook and Federation suffered severely.

(2) *Smith Bros., Tua Marina.*—Date sown : 22nd August, 1935. Date harvested : 30th January, 1936.

When cut S.S. Tuscan had a very poor appearance, and had been heavily attacked by rust. Cross 7 was also showing rust to some extent.

Table I.—Yields of Marlborough Trials, 1935–36.

Variety.	Omaka. Yield per Acre.	Omaka. Increase over S.S. Tuscan.	Tua Marina. Yield per Acre.	Tua Marina. Increase over S.S. Tuscan.
	Bushels.		Bushels.	
S.S. Tuscan	34·4	..	30·1	..
Cross 7	33·8	−0·6	32·2	2·1
Marquis	30·6	−3·8	39·3	9·2
Federation	29·9	−4·5	36·7	6·6

Differences were not examined statistically.

B. *Trials with Spring-sown Wheats.*

Varieties compared: S.S. Tuscan, Cross 7, Jumbuck, Nabawa, Ford, Tainui, and Taiaroa.

(3) *J. O. Redfern, Darfield.*—Date sown: 14th August, 1935. Date harvested: 21st January, 1936.

Some of the plots were damaged by weather, but sufficient were harvested for estimation of yield.

(4) *Mrs. C. Hall, St. Andrews.*—Date sown: 9th September, 1935. Date harvested: 12th March, 1936.

Plots were over-ripe, as cutting had been delayed by weather. Tainui suffered the most through not being cut at the right stage.

(5) *A. Grant, Waimate.*—Date sown: 16th September, 1935. Date harvested: 18th February, 1936.

In the early stages Jumbuck appeared poor, and did not appear to have tillered well. The grain of all varieties was badly sprouted through adverse weather conditions.

Table II.—Yield in Bushels per Acre of Spring-sown Trials, 1935–36.

Variety.	(3) Darfield. Yield.	(3) Darfield. Increase over S.S. Tuscan.	(4) St. Andrews. Yield.	(4) St. Andrews. Increase over S.S. Tuscan.	(5) Waimate. Yield.	(5) Waimate. Increase over S.S. Tuscan.
S.S. Tuscan	33·4	..	24·1	..	22·2	..
Cross 7	31·5	−1·9 N.S.	25·5	1·4 N.S.	26·5	4·3 S.
Jumbuck	32·2	−1·2 N.S.	17·8	−6·3 S.	24·8	2·6 N.S.
Nabawa	33·3	−0·1 N.S.	27·0	2·9 S.	29·7	7·5 S.
Ford	33·8	0·4 N.S.	29·6	5·5 S.	27·8	5·6 S.
Tainui	45·4	12·0 S.	29·6	5·5 S.	39·0	16·8 S.
Taiaroa	42·4	9·0 S.	36·4	12·3 S.	29·7	7·5 S.

In this and the tables which follow S. denotes significant difference and N.S. difference not significant.

C. *Trials with Lines of Cross 31.*

Varieties compared: S.S. Tuscan, six lines of Cross 31. (Cross 7 was included in the Lincoln College trial.)

(6) *R. and P. Campbell, Kingsdown.*—Date sown: 1st August, 1935. Date harvested: 10th February, 1936.

Prior to harvest the lines of Cross 31 did not appear to be as well grown as the Tuscan plots.

(7) *Lincoln College.*—Date sown: 30th April, 1935. Date harvested: 20th January, 1936.

The trial was carried out by the Wheat Research Institute, but results are included for comparison with trial 6.

Table III.—Yield in Bushels per Acre of Lines of Cross 31 as compared with S.S Tuscan, 1935-36

Variety.	(6) Kingsdown.		(7) Lincoln.	
	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.
S.S. Tuscan (mean)	47·3	..	66·6	..
Cross 31,01	46·4	−0·3 N.S.	75·3	4·7 S.
Cross 31,02	48·8	2·1 N.S	75·1	7·9 S.
Cross 31,03	47·1	−0·2 N.S.	77·2	11·4 S.
Cross 31,04	46·8	−0·5 N.S	75·6	8·4 S.
Cross 31,05	46·3	−1·7 N.S	80·6	13·1 S
Cross 31,06	45·0	−2·9 S.	78·2	10·0 S.
Cross 7	..	..	74·1	3·6 S

D. *Other Trials.*

Two experiments with selections of S.S. Tuscan were carried out, but did not show any superiority of the selections over commercial Tuscan. Four small-scale trials were sown in Otago and Southland, and the varieties included were S.S. Tuscan, Taiaroa, Jumbuck, Montana King, and Cross 7. The trials consisted of hand-sown plots protected by bird-netting. At harvest they were cut by hand, and the sheaves were forwarded to the Wheat Research Institute for threshing. The strike was a failure in one of the trials, and it had to be abandoned. Jumbuck gave distinctly poor returns in all three trials, while Montana King was only a little better. Cross 7 was poor at two centres, and was equal to Tuscan at the third. Taiaroa yielded as much as Tuscan at Greenfield and Benmore, and there was an indication that it yielded as much as Tuscan or possibly more at Winton, where, however, its straw was slightly tangled.

SUMMARY OF 1936-37 SEASON'S TRIALS.

Twelve experiments were carried out by the Fields Division in 1936-37, and these included three small-scale trials in the North Island. Owing to excessive growth of wild tares, one experiment in the Ashburton district had to be abandoned. The yields and remarks on the varieties are as follows:—

A. *Marlborough Trials.*

Varieties compared: Cross 7, Marquis, Tainui, Jumbuck, and Federation.

(1) *F. F. Mills, Grovetown.*—Date sown: 11th July, 1936. Date harvested: 15th January, 1937.

At time of cutting most of the varieties were down except Cross 7. Tainui was the first to ripen, followed by Marquis and Jumbuck, and then Cross 7.

(2) *I. Brown, Grovetown.*—Date sown: 8th July, 1936. Date harvested: 12th January, 1937.

Difficulty was experienced in harvesting all varieties except Cross 7, on account of lodging, and this was particularly so in the case of Marquis. Cross 7 was perfectly upright and showed no signs of lodging.

Table IV.—Yields in Bushels per Acre in Marlborough Trials, 1936 37.

Variety.	(1) Grovetown Yield.	(1) Grovetown Increase over Cross 7.	(2) Grovetown. Yield.	(2) Grovetown. Increase over Cross 7.
Cross 7	59·4	..	49·2	..
Marquis	60·9	1·5	54·7	5·5
Tainui	53·8	−5·6	53·5	4·3
Jumbuck	59·1	−0·3	*	*
Federation	*	*	55·3	6·1

* Not included.

B. *Trials with Cross 31*

Varieties compared: S.S. Tuscan, Cross 7, Lin Calel, and Crosses 31,02, 31,03, and 31,05.

(3) *Mrs. C. Hall, St. Andrews.* Date sown: 18th June, 1936. Date harvested: 16th February, 1937.

All plots were ripe when cut. Cross 7, Crosses 31,02 and 31,03, as well as Tuscan were slightly over-ripe, but no shedding of grain had taken place. Cross 31,05 had lodged badly, and S.S. Tuscan to some extent.

(4) *E. A. Payne, Amberley*—Date sown: 28th May, 1936. Date harvested: 28th January, 1937.

No differences were observed between varieties at harvest; all were ripe.

Table V.—Yields in Bushels per Acre in Trials with Crosses 31, 1936–37

Variety.	(3) St. Andrews. Yield.	(3) St. Andrews. Increase over S.S. Tuscan.	(4) Amberley. Yield	(4) Amberley. Increase over S.S. Tuscan.
S.S. Tuscan	34·3	..	27·0	..
Cross 31,02	45·1	10·8 S.	30·3	3·3 S.
Cross 31,03	46·6	12·3 S.	29·8	2·8 N.S.
Cross 31,05	42·3	8·0 S	30·2	3·2 N.S.
Cross 7	39·0	4·7 N.S	30·1	3·1 N.S.
Lin Calel	33·7	−0·6 N.S.	29·1	2·1 N.S.

C. *Trials with "Spring" Wheats.*

Varieties compared: S.S. Tuscan, Cross 7, Lin Calel, Tainui, Jumbuck, and Bencubbin.

(5) *G. Warren, Darfield.*—Date sown: 12th August, 1936. Date harvested: 11th February, 1937.

Tainui and Jumbuck ripened earlier than the remainder, and were badly attacked by birds. Lin Calel, which is a bearded variety, was definitely not attacked.

(6) *G. Stevenson, Weston.*—Date sown: 25th August, 1936. Date harvested: 26th February, 1937.

At harvest S.S. Tuscan was slightly green, but sufficiently mature to cut. The remainder were ripe. Hessian fly had attacked Tainui, Jumbuck, Lin Calel, and Bencubbin, resulting in damage to the straw,

(7) *Manly Bros., Duntroon.*—Sown on 10th June, 1936. Jumbuck, Tainui, and Bencubbin were harvested on 13th January, 1937. Lin Calel, S.S. Tuscan, and Cross 7 were harvested on 1st February, 1937.

When cut Bencubbin had shaken rather badly, while Jumbuck and Tainui had also shed some grain.

Table VI.—Yields of Varieties in Type C Trials, 1936–37 (Bushels per Acre).

Variety.	(5) Darfield		(6) Weston.		(7) Duntroon.	
	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S. Tuscan.	Yield.	Increase over S.S Tuscan.
S.S Tuscan ..	20·0	..	20·6	..	23·9	.
Cross 7 ..	24·8	3·9	20·2	−0·4 N S.	24·4	0·5 N S
Lin Calel ..	29·7	8·8*	19·2	−1·4 N S	21·9	−2·0, N S.
Tainui ..	25·0	4·7†	18·5	−2·1 N S	17·9	−6·0 S
Jumbuck ..	16·4	− 4·5†	14·2	−6·4 S	17·4	−6·5 S
Bencubbin	..	..	16·8	3·8 N S	23·4	−0·8 N S.

* Neglected by birds. † Badly attacked by birds

D. *Ecological and North Island Trials.*

A large ecological trial was sown on the farm of P. R. Talbot, Claremont, in which twenty-seven lines of Crosses 36 and 60 were tested on behalf of the Wheat Research Institute. It is not intended, however, to quote results in this report.

In the North Island small-scale trials comparing Jumbuck, Tainui, and Taiaroa were laid down at Feilding, Marton, and Colyton respectively. These plots were hand-sown, and at harvest cut by hand, the sheaves being forwarded to the Wheat Research Institute for threshing. Tainui was significantly better than Jumbuck at all centres, and was significantly higher in yield than Taiaroa at Marton and Colyton. Taiaroa outyielded Jumbuck significantly at Feilding.

SUMMARY.

The main features of the two seasons' results given above are summarized below:—

(1) *Cross 7.*—In comparison with Solid Straw Tuscan, Cross 7 performed well during the two seasons under review. Although in Marlborough Cross 7 did not show up to the same advantage as it has done in previous seasons, and was in fact outyielded by Marquis in three out of four trials, in view of its earliness, excellent straw, and reliable yield, Cross 7 can still be recommended. During the past two seasons in Canterbury Cross 7 has never been outyielded by Tuscan, and was definitely superior in two trials. Its resistance to lodging, shorter straw, and earlier maturity have been valuable characteristics in view of the weather conditions experienced at harvest.

(2) *Tainui and Taiaroa.*—Both these varieties show good promise as spring wheats. Tainui appears particularly suitable for Canterbury, while Taiaroa is apparently more suited to South Otago conditions. A nucleus of seed of these varieties is being raised at the Pure Seed Station, and stocks will be ready for limited distribution for the sowing-season of 1938. In the meantime further trials with Tainui are contemplated in the North Island, where the possibilities of this variety are indicated especially in localities in which lodging as a rule is not severe

(3) *Cross 31.*—As an alternative to Solid Straw Tuscan some of the lines of Cross 31 show distinct possibilities Three of the lines of Cross 31 have performed well in both seasons in relation to Tuscan At Lincoln in 1935-36 and St Andrews in 1936-37 there was a wide margin in favour of the Crosses. Two of these lines, 31,02 and 31,05, have been retained for further trial.

(4) *Jumbuck.*—This variety has not shown to advantage in any of the trials. Owing to its early maturity, it has in some cases suffered from bird damage, which has been reflected in decreased yield.

(5) *Lin Calel.*—Both in autumn and spring sowings this variety has shown good promise, and out of five trials it was equal to Tuscan in four and superior in one, although in the latter there may have been differential damage by birds

(6) *Other Varieties*—Bencubbin has not shown any advantage over Tuscan in the two North Otago trials, although the prolonged drought during winter and spring probably favoured Tuscan and other later varieties In Marlborough the variety known as "Federation" was inferior to Cross 7 in one trial and superior in two experiments, but in the two latter Marquis has also performed well. The yields from Marquis during the last few years' trials in Marlborough give further foundation to the popularity of this variety in the province. The two Australian varieties Nabawa and Ford gave good yields, but neither gave the same promise as Tainui as a satisfactory spring wheat for Canterbury conditions.

ACKNOWLEDGMENTS

The Department extends its thanks to those farmers who provided land and facilities for carrying out the experiments. The field-work in the large-scale trials was carried out under the direction of Mr. R. McGillivray and Mr. J. M. Smith, Fields Superintendents at Christchurch and Dunedin respectively, by the following Instructors: H. de O. Chamberlain and D. R. Wilkie, Marlborough, A. V. Allo, Christchurch; C. C. Leitch, Timaru; T. Sellwood, Oamaru.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published recently in the *New Zealand Patent Office Journal*, include the following of agricultural interest.—

No. 77980: Milking-machine; R. J. Daniell No. 78007: Butter-pounding attachment; G. McHugh. No. 78017: Milking-machine; Aktiebolaget Separator. No. 78026: Casein-drying machine; Mullan and Foy No. 78040: Animal drencher; W. Peirson. No. 78042; Ragwort-gun; J. Morice No 78044: Fertilizer-distributor; K. Burgess. No 78056: Grass-drying means; Kaloroil Burners, Ltd., and A. Goldberg. No. 78072: Milk-process; F Jung No 78102: Honey-purification process; Cawthron Institute Trust Board. No. 78106: Drench-administering gun; Loudon Brothers, Ltd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid

EXPERIMENTS ON THE CONTROL OF TOMATO LEAF-MOULD.

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LEAF-MOULD (*Cladosporium fulvum*) is, in New Zealand, the most troublesome and widely spread disease of glasshouse tomatoes. It was first recorded in the Dominion by Kirk in 1897. Chamberlain (1932) published an account of this disease, giving symptoms, economic significance, life history, and preventive measures. It was pointed out that the basis of any successful treatment must be the provision of adequate ventilation. It is not possible, however, under all conditions to provide sufficient ventilation to prevent leaf-mould from becoming established. In such circumstances it is the practice to apply therapeutants to help keep the disease in check. The present investigation was directed to the determination of the relative efficiency of those commonly recommended. In this article the results are recorded of three seasons' (1934–36) experiments. They were carried out at Lower Hutt, Wellington, in commercial glasshouses made available through the courtesy of the Hutt Valley Tomato-growers' Association.

EXPERIMENTAL METHOD.

Experiment I (1934) was carried out in an unheated glasshouse where leaf-mould had previously occurred, and experiment II (1935) in a newly constructed unheated house. In the latter a high percentage of infection developed, and the same house was used in 1936 for experiment III.

Treatments were commenced when the plants were 12 in. to 18 in. high before the disease was observed on any plants. Applications were continued every eighteen to twenty-one days in experiments I and II, and at fourteen-day intervals in experiment III, until harvesting commenced, the plants then being 6 ft. to 7 ft. high.

In 1934 a bucket pump with cyclone nozzle was used for the first three applications, and knapsack sprayers with bordeaux nozzles for the fourth. The first two sprayings during 1935 were applied by means of a bucket pump and the last two with knapsacks, while in 1936 a bucket pump was used throughout. With the bucket pump it was possible to maintain a good pressure and provide a driving mist of fine particles. Only a low pressure (10 lb. to 15 lb.) could be secured with the knapsack sprayer, and this resulted in a coarse spray, having poor penetration. In all cases the operator endeavoured to secure a good spray coverage on both sides of the leaves. A noticeably better coverage was obtained with the bucket pump. In all experiments sprays were applied at a rate necessary for adequate cover, requiring half a gallon per row of thirteen to fourteen plants for the first treatment, and increasing with each application to 1 gallon per row for the final treatment.

Dusts were applied with a rotary hand-blower during 1934 and 1936, and with a small hand-duster in 1935. An attempt was made to secure a covering of dust particles on both the upper and lower leaf surfaces.

After leaf-mould infection was observed, counts were taken of the number of lesions on one leaf of each plant at approximately the same height. Further counts were made immediately before each subsequent application. Although this method of determining the relative amounts of infection occurring in the various treatments was not entirely satisfactory, the short time at our disposal did not permit of more comprehensive measurements.

The crops were visited only at the time of spraying, and the management of the glasshouses was left entirely in the hands of the growers. Under these circumstances there was no correlation between the spraying experiments and the more important means of control by ventilation.

MATERIALS USED.

(1) *Ground Sulphur (Flour Sulphur).*—The particle size varies considerably according to the grade of sample, ranging from a minimum of about 4 μ to a maximum of 250 μ. It was employed as a dust both alone and in combination with gas-sulphur.

(2) *Sublimed Sulphur (Flowers of Sulphur).*—This material consists of particles varying from 8 μ to 30 μ aggregated into groups, sometimes attaining a size of 400 μ. The aggregates do not break up when applied to the plants. Sublimed sulphur was used as a dust only.

(3) *Gas-sulphur.*—The particle size ranges from 2 μ to 10 μ with an average of about 5 μ. In these experiments one product of this type was used as a spray and two others as dusts, one of the latter being in combination with ground sulphur.

(4) *Colloidal Sulphur.*—Sulphur in a very fine state of subdivision, the majority of particles being 0·1 μ to 0·5 μ. Colloidal sulphurs are available in the form of pastes containing 40 per cent. to 50 per cent. of sulphur. They also contain a colloid which acts as a dissociant and a suspensor.

(5) *Lime-sulphur.*—The active constituent of lime-sulphur is a mixture of polysulphides of calcium. The polysulphide content of the products used was 18 per cent. in experiment I and 15 per cent. in experiments II and III.

(6) "*Shirlan A.G.*"—A proprietary product composed of 25 per cent. salicylanilide, 10 per cent. of a wetting-agent ("Agral"), and 65 per cent. water. The salicylanilide, which is the active constituent, has a particle size of 0·5 μ to 12 μ, the majority of particles being 1 μ to 2 μ.

(7) "*Agral.*"—This is a proprietary organic wetting-agent.

EXPERIMENT I (1934).

Treatments were carried out on the following varieties: "Britain's Best," 7 rows; "Salad Gem," 46 rows; "Marvel," 18 rows; and

"Kondine Red," 9 rows. Sprays applied were as follows: "Shirlan A.G.," 0·3 per cent.; colloidal sulphur, 0·2 per cent.; gas-sulphur, 0·2 per cent.; lime-sulphur, 0·083 per cent.*; lime-sulphur, 0·083 per cent., plus colloidal sulphur, 0·2 per cent. Sublimed sulphur was used as a dust. Untreated control plots were left between each set of six treatments. The first application was made on September 26th, and subsequent applications on October 16th and November 1st and 19th.

Results.—Leaf-mould was first observed on October 16th, 1934, infection being confined to occasional leaves on scattered plants. On November 1st counts were taken and these showed that "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur all gave some measure of control. Colloidal sulphur and gas-sulphur did not reduce infection, while lime-sulphur plus colloidal sulphur had no advantage over lime-sulphur alone.

The plants were again examined on November 19th and December 7th, but leaf-mould infection was so severe that no counts were taken. Observations showed that there was a slight reduction in incidence of infection on plants treated with "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur, but the other treatments had no apparent effect on the disease.

EXPERIMENT II (1935).

The varieties treated were "Early Market," 39 rows, and "Peter's Special," 27 rows. The treatments carried out were as follows: "Shirlan A.G." 0·3 per cent., colloidal sulphur 0·2 per cent., lime-sulphur 0·083 per cent., lime-sulphur 0·083 per cent. plus colloidal sulphur 0·2 per cent. as sprays; and sublimed sulphur and gas-sulphur as dusts. Applications were made on October 8th and 25th and November 12th and 29th.

Results.—Leaf-mould was first observed on November 12th, 1935, when occasional lesions were found on plants scattered throughout the house. During the next two visits counts were taken, the results of which are given in Table I. They show that "Shirlan A.G.," lime-sulphur, lime-sulphur plus colloidal sulphur, and sublimed sulphur all brought about some reduction in amount of infection. Lime-sulphur plus colloidal sulphur appears to have been slightly more effective than the others, and sublimed sulphur slightly less so. Colloidal sulphur alone and gas-sulphur dust had little effect on the disease.

A final inspection of the plants was made on December 20th, 1935, and all plants found to be heavily infected. From observations it appeared that in the case of the variety "Early Market" "Shirlan A.G." was the only treatment which had had any beneficial effect on the plants. Plants treated with this material not only appeared to show less leaf-mould, but also less of a physiological scorch which was present on leaves of plants in all other treatments and controls. In the case of the variety "Peter's Special," plants treated with "Shirlan A.G.," lime-sulphur, and lime-sulphur plus colloidal sulphur were slightly healthier in appearance than those of the controls or of the other treatments.

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* Lime-sulphur 0·083 per cent. and 0·1 per cent refers to the percentage of polysulphide. Thus—

Lime-sulphur 0·083 per cent. = 1–216 for a lime-sulphur of 18 per cent. polysulphide content, and 1–180 for a lime-sulphur of 15 per cent. polysulphide content.

Lime-sulphur 0·1 per cent. = 1–180 for a lime-sulphur of 18 per cent. polysulphide content, and 1–150 for a lime-sulphur of 15 per cent. polysulphide content.

Table I.—Results of Experiment II, 1935.

Treatment.*	Percentage.	Number of Rows.	Average Number of Lesions per Row.	
			Nov. 12th, 1935	Nov. 28th, 1935.
VARIETY "EARLY MARKET," THIRTEEN PLANTS PER ROW.				
Check	..	2	25	74
Colloidal sulphur .. .	0·2	2	32	65
Gas-sulphur	Dust	2	25	72
Sublimed sulphur	Dust	2	23	75
"Shirlan A.G."	0·3	2	39	40
Check	..	2	81	173
Lime-sulphur .. .. . Colloidal sulphur	0·083+ 0·2	2	38	70
Lime-sulphur	0·083	2	32	143
"Shirlan A.G." . .	0·3	2	23	73
Gas-sulphur	Dust	2	20	98
Check	..	2	22	144
Sublimed sulphur .	Dust	2	10	51
Colloidal sulphur	0·2	2	17	85
Lime-sulphur . .. .. Colloidal sulphur .. .	0·083+ 0·2	2	17	32
Lime-sulphur	0·083	2	34	53
Check	..	3	39	94
Lime-sulphur	0·083	3	22	55
Check	..	3	30	77
VARIETY "PETER'S SPECIAL," THIRTEEN PLANTS PER ROW.				
Sublimed sulphur	Dust	3	3	49
Check	..	3	10	79
Gas-sulphur	Dust	4	17	95
"Shirlan A.G."	0·3	4	18	59
Lime-sulphur	0·083	4	16	85
Check	..	3	23	127
Colloidal sulphur	0·2	3	18	88
Lime-sulphur .. .. .. Colloidal sulphur	0·083+ 0·2	3	12	35

* The order of the treatments as listed in both tables represents their relative positions in the glass-house.

Plants treated with gas-sulphur were showing noticeable leaf injury* when examined on November 12th, and this was still apparent on November 28th.

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* This injury was probably induced by impurities often present in this product.

Table II.—Results of Experiment III, 1936.

Treatment.	Percentage.	Number of Rows.	Average Number of Lesions per Row.		
			Nov. 13th, 1936.	Nov 27th, 1936.	Dec. 11th, 1936.
VARIETY "EARLY MARKET," FOURTEEN PLANTS PER ROW.					
West Side of Glasshouse.					
Check	..	1	15	120	87
Lime-sulphur ..	0·1	2	6	13	36
Lime-sulphur .. " Agral "	0·083+ 0·1	2	0·5	5	6
Check	..	2	12	16	14
Lime-sulphur ..	0·083	2	2·5	8	13
Sublimed sulphur ..	Dust	2	10	20	13
Check	..	2	8	5	8
Gas-sulphur .. Ground sulphur ..	20+ 80 Dust	2	11	16	19
" Shirlan A.G." ..	0·47	2	2·5	1	7
Check	..	2	13	25	52
" Shirlan A.G." ..	0·23	2	3	3	2
Lime-sulphur ..	0·1	2	1·5	8	15
Check	..	2	20	19	52
" Shirlan A.G." ..	0·47	2	7	17	33
Lime-sulphur ..	0·083	2	9	19	50
Check	..	2	30	44	129
Ground sulphur ..	Dust	2	30	34	93
Check	..	1	22	52	88
East Side of Glasshouse.					
Check	..	1	18	42	42
Sublimed sulphur ..	Dust	2	14	10	18
Ground sulphur ..	Dust	2	10	3	4
Check	..	2	10	16	9
" Shirlan A.G." ..	0·23	2	1·5	3	0
" Shirlan A.G." ..	0·47	2	0·5	1	0·5
Check	..	2	3	9	13
Lime-sulphur .	0·083	2	4	3	18
Lime-sulphur ..	0·1	2	3	10	13
Check	..	2	16	46	28
Lime-sulphur .. " Agral "	0·083+ 0·1	2	6	6	6
Sublimed sulphur ..	Dust	2	1·5	4	13
Check .. .	..	2	31	37	35
Gas-sulphur .. Ground sulphur ..	20+ 80 Dust	2	16	18	25
" Shirlan A.G." ..	0·23	2	1	3	1·5
Check	..	2	16	31	31
" Shirlan A.G." ..	0·47	2	4	3	3
Check	..	1	32	70	97

EXPERIMENT III (1936).

Only one variety—Early Market—was treated. The fungicides applied were—" Shirlan A.G." 0·23 per cent., " Shirlan A.G." 0·47 per cent., lime-sulphur 0·1 per cent., lime-sulphur 0·083 per cent., and lime-sulphur 0·083 per cent. plus " Agral " 0·1 per cent., as sprays; and sublimed sulphur, ground sulphur, and gas-sulphur 20 per cent. plus ground sulphur 80 per cent. as dusts. Applications were made at fourteen-day intervals from October 2nd to November 27th.

Results.—The crop, when examined on October 16th and 30th, showed only a trace of leaf-mould. Counts were taken on November 13th and 27th and on December 11th. Results, given in Table II, show that all treatments gave some control, although in the case of gas-sulphur plus ground sulphur it was slight. " Shirlan A.G." at either strength appears to have given the best and most consistent results, although only slightly more effective that lime-sulphur plus " Agral." The dust treatments were not as efficient as the sprays. None of the treatments caused injury to the plants

TOMATO LEAF-MOULD, SHOWING THE PURPLISH-BROWN VELVETY LESIONS WITH WHITE MARGINS ON UNDERSIDE OF LEAF. [*Photo by H. Drake.*

RECOMMENDATIONS.

No treatment has yet been evolved to give satisfactory control of leaf-mould, unless accompanied by some regulation of the humidity of the glasshouse. Therefore the application of therapeutants cannot be used as a substitute for adequate ventilation.

Of the materials tested in the foregoing experiments, " Shirlan A.G." gave the most consistent results. It is recommended at a concentration of 0·3 per cent. (3 lb. to 100 gallons). Applications should be made with a pressure-pump (60 lb. pressure), and a good spray coverage obtained on both sides of the leaves.

SUMMARY.

(1) The paper covers three years' experiments on the control of tomato leaf-mould (*Cladosporium fulvum*) by the use of therapeutants.

(2) It is shown that where conditions are favourable for its development leaf-mould cannot be successfully controlled by any of the materials tested.

(3) The following is the approximate order of merit of the therapeutants used: "Shirlan A.G.," lime-sulphur plus "Agral," lime-sulphur plus colloidal sulphur, lime-sulphur, sublimed sulphur, ground sulphur, colloidal sulphur, gas-sulphur plus ground sulphur, gas-sulphur spray, and gas-sulphur dust. Of these, the first four proved sufficiently effective to warrant their use.

(4) Under the conditions of the experiments, gas-sulphur dust alone caused foliage injury.

(5) "Shirlan A.G." spray at a concentration of 0·3 per cent. gave consistently the best control of leaf-mould.

ACKNOWLEDGMENT.

We desire to record our appreciation to Messrs. Cooksley and Feretti for the use of their glasshouses, plants, and assistance given by staff, and also to the Hutt Valley Tomato-growers' Association for procuring the use of these houses for the experiments.

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A HISTORY OF THE NEW ZEALAND DAIRY INDUSTRY.

IN this book, for the first time, the principal historic details of the development of New Zealand's great dairying industry have been gathered together, the more important headings being the work of the pioneers, the founding of the dairy factories, refrigeration as applied to the dairy industry, the spread of co-operation, the establishment of the export trade, the grading system, the introduction of home-separation, the importation of dairy cattle, and legislation.

In the twenty-one chapters which comprise the four hundred pages of this work every important phase of New Zealand's dairying industry has been dealt with, while the period covered is from colonization (1840) to the end of 1935, with a supplementary summary relating to 1936. In all, some 170 dairy factories and over 300 persons are mentioned. The book is profusely illustrated, there being thirty-eight pages of illustrations comprising sixty-six pictures of personalities, dairy factories old and new, dairy stock, and general subjects. Many of the pictures appear for the first time.

A statistical appendix includes many tables not previously compiled, and presents a complete statistical survey from the earliest recorded figures to the present day.

The author of the book is Mr. H. G. Philpott, of the Dairy Division, Department of Agriculture. Mr. G. M. Valentine, Assistant Director of the Dairy Division, contributed a chapter on "Dairy Machinery and Appliances," while there is a foreword by the Hon W. Lee Martin, Minister of Agriculture, and a preface by Mr. W. M. Singleton, Director of the Dairy Division

The book is being made available to purchasers at cost of publication, namely 15s. per copy, or 15s. 8d. post free. [N.B.—Cheques must bear exchange.]

Copies may be had from The Director-General, Department of Agriculture, Private Bag, Wellington

MOULD PENETRATION IN NEW ZEALAND CHEESE.

G. M. VALENTINE, Assistant Director, Dairy Division, Wellington

THE development of mould on the rinds of cheese during ripening is a natural process unless special care is taken to prevent it, and mould penetration probably has been known as long as cheese has been made. Complaints regarding this defect have been received from London from time to time ever since the export of cheese commenced, but they seem to have been increasingly frequent during recent years, and particularly during the 1935 36 season.

During the period from 17th December, 1935, till 21st December, 1936, forty-seven special reports on mould penetration were received from the London officers of the Dairy Division. These represented cases in which complaints were received by them from importers, wholesalers, and retailers, and in most instances referred to mould seams which were found in the interior of the cheese when cut for sale

In view of the quantity of cheese shipped during that period, totalling 84,494 tons, the number of complaints received was comparatively small, but it can be accepted that they did not cover all cases of mould penetration. As the defects were a source of annoyance to users and a loss of good will to New Zealand, they cannot be treated lightly, and steps must be taken to reduce them as much as possible.

The forty-seven complaints were spread over thirty-one factories as follows: Cheese from one factory was complained of on six separate occasions, one three times, nine on two occasions, and twenty once

The various grading-stores were affected as follows: Bluff, nineteen complaints in respect of the cheese from nine factories; Wellington, seven from four; Patea, six from five, New Plymouth, five from five; Wanganui, four from two; Dunedin, three from three; Auckland, two from two; and Lyttelton, one from one.

There is no means of determining the aggregate amount of cheese affected, but the reports received seldom had any reference to more than one or two crates, and allowances for a few pounds of waste cheese. Some, however, concerned fairly large parcels, as follows: "2½ cwt. returned to warehouse"; "40 lb. lost"; "161 lb. loss on 140 crates"; "80 lb. to 90 lb. waste plus £5 allowance made"; "loss of 340 lb on 34 crates."

LONDON REPORTS.

In most of the reports an attempt had been made to indicate the possible cause of the mould penetration, and this is dealt with by Mr. F. H. Taylor, Inspector of New Zealand Dairy Products, London, in a letter dated October, 1935, which reads in part as follows:—

> "During the past week I visited Messrs. ——'s store in London to investigate a complaint regarding mould in cheese. At the time of my visit these people had cut some three crates of cheese and from these six cheese approximately 20 lb. of pieces were laid aside as being unsuitable for their counter trade. On examination it was noticed that in some instances the mould penetration had

started fairly well down the wall, and some cracks were noticed in the rinds which would indicate that the cheese had been damaged at some stage.

" There seem to me to be two possible explanations for the frequent occurrence of this mould penetration. Firstly, I have noticed that in nearly all cases where this trouble has occurred it has been found on examination that the rims are very small. This would seem to indicate that if the cheese are made in the old type of hoop there does not seem to be sufficient curd to allow for the correct amount of pressure, and this probably causes looseness. The second explanation might be that the cheese are being damaged prior to being put into the crates. The examination of this particular cheese would seem to indicate that the walls had been bumped on a sharp corner, possibly on the shelf during turning. I can see no other reason for the cheese developing this trouble There is the old explanation of the faulty mixing of the cold curd, but an examination of a number of these cheese would lead one to suppose that this was not the cause of the trouble, as the cheese on either side of the mould seam showed that the curd was the same and had knitted thoroughly prior to the development of the mould. I think we shall have to look to the curing-room for the explanation of the greater percentage of this trouble.

" Judging by some of the cheese which I have seen displayed in various retail grocers' shops, I am sure that we are not hearing all that could be said about this complaint. Numbers of pieces of cheese which I have seen have shown mould penetration to a greater or lesser degree, but unless they are very badly affected, or involve some considerable loss, nothing is said about the matter.

" By way of comment, it is interesting to note that Cheshire cheese which has developed this defect appears to sell at a premium. I have seen several of these displayed in shop-windows and marked as " Blue Cheshires." For some reason these are considered to be something of a luxury, whereas the slightest defect of this sort in Cheddars leads to complaints, and retail counter assistants state that they are difficult to dispose of."

Complaints received during the period mentioned have been grouped under the following headings :—

Cracked rinds	14
Cracked crowns	11
Cracks under rims	8
Mould seams (2 tops, 2 bottoms)	4
Loose crowns	5
Loose bottoms	4
Mould seams in close cheese	3
Cracked rims, ends, sides, and generally in bad condition	7

CAUSES OF FAULTS.

Suggestions as to the possible cause of these faults were also made as follows :—

" Faulty crowns—curd not knitted " ; " rims and walls cracked suggests cold curd " ; " bad rinds and crowns—not properly pressed." These seem to indicate either that the hoops have not been filled full enough or that the pressure on the presses had not been maintained.

"Cracked rinds" suggests lack of scalding, or cheese being in a draught or acidy, while the number of complaints of cracked crowns seems to indicate that curd has been added at dressing to build up the cheese. This method of "sizing" was actually suggested at one meeting of managers, although the more general method followed is to over-fill the hoops and cut the cheese down at dressing.

Cracks under the edges would suggest that the rim is the cause of this defect if it were not for the fact that the detached ends are not confined to the top of the cheese. They are probably the starting-point for the mould seams and the loose tops and bottoms complained of, the last two being a later stage of development of the first. It is not difficult to understand how mould which has gained access through cracks in the rim to the concave lines of slits which show across all open cheeses from top to bottom when cut in half should develop rapidly when the crown is detached from the rest of the cheese. But it is difficult to understand the detachment of an almost similar concave piece from the bottom of the cheese where these lines are almost straight, unless it be due to "huffing."

The following quotations give a possible explanation: "Loose bottom—cracked side"; "fracture one third distance up -probably jarred when green." The necessity for careful handling of the cheeses while in a green state cannot be too much stressed, as any one who has examined cheese with cracked rims is immediately impressed with the feeling that rough handling was the probable cause. This would at once suggest that defects of this class would be more common in cheese which is transported to a central curing-room while in a green condition, but a survey of the complaints received shows that only one referred to cheese handled in this way.

More difficult still is it to understand the growth of mould in close cheese free from slits: "Close cutting, but slightly moulded"; "small crack, mould vein right across cheese, close cheese with no mechanical or slitty openings—suggest mould contamination before hooping." It is accepted that mould cannot grow except in the presence of air, and the above suggests that the amount needed is very small.

CONTAMINATION FROM CLOTHING.

Mould or mould spores are present in all cheese-factories to a greater or lesser extent, but heavy contamination from the clothes of employees who have been working in the curing-room (some of which contain stocks of cheese for local sale which are heavily coated with mould) and at a later period take part in handling the curd in the vats has been suggested as a probable cause of contamination.

Cheese in bad condition at all points may be due to many causes from the making process up to final disposal, as there are quite a number of probable reasons for the development of cracks in the skin of a poorly made cheese, more especially when it is held in a poor curing-room. A survey of the curing-rooms at those factories about which a number of complaints were received has shown that most of them were poorly ventilated, and in such a condition that the growth of mould was encouraged. Extracts from reports read as follows:—

(*a*) "Previous to this curing-room being ventilated it was regarded as a very damp room, and doubtless the position in previous years was aggravated somewhat by the storage of local-market cheese, which invariably become mouldy."

(*b*) "With reference to this curing-room it is now receiving attention, and with the extra ventilation provided should assist in preventing excessive mould growth. It has always been recognized to be a very damp one."

(*c*) "This curing-room has always shown excess mould development, and the manager has undertaken to provide more ventilation."

Later—"It is now adequately ventilated and freer from mould than at any time previously."

(*d*) "This room was ventilated during the winter months, and is this year much freer from mould."

It would be unsound to attribute all cases of mould penetration to the condition of the curing-room, as it is true of both cool stores and ships that, while some are practically free from mould, others are the reverse. It can be claimed, however, that the curing-room should be so constructed and controlled that the possibility of contamination, even of cheese with defective rinds, will be reduced to a minimum.

ACCESS OF AIR.

During investigations which he carried out during 1929–31 into the question of discoloration in New Zealand cheese, Mr. G. F. V. Morgan, at that time bacteriologist to the Division, showed that all cases of mould penetration were connected with a break in the rind of the cheese, which allowed the access of air. During the 1931–32 season a very large number of reports were received from London on the prevalence of discoloration in New Zealand cheese, and Mr. Morgan formed the opinion that mould penetration was probably the cause of, or had a connection with, the discoloration. Because of this belief instructions were at that time issued to all cheese instructors to pay particular attention to the finish of the cheese and the care of the curing-rooms at all factories, and these matters have since received close attention.

On 13th January, 1936, a circular letter was sent to all cheese-factory managers drawing attention to the number of complaints being received regarding mould penetration, and stressing the need for care in handling the cheese, and proper mixing of curd carried over from one day with the following day's make before dipping.

As complaints continued to come forward from London, the question was referred to the Acting Director of the Dairy Research Institute, who suggested that the loose crowns and bottoms were possibly due to gas produced by lacto-bacilli in open cheese, and raised the question as to whether mould penetration occurred in close cheese. It was further suggested that, if the above theory was correct, the cure lay in making close cheese, and that the problem was therefore the same one as openness in general.

The question whether mould penetration was found in close cheese was referred to Mr. Taylor, and it will be noted that it is really answered by the instances already quoted in which close cheese was affected.

Under date of 23rd October, Mr. Taylor replied to this letter, and the following is a summary:—

> "Mould seams are found in both open and close cheese. Openness will make it easier for mould to spread. Cheese appeared to have huffed up at some time and allowed mould to develop in the seam. More complaints from Southland than other provinces."

It should be stated that as the result of his observations in England Mr Robertson considers the huffing theory to be worth further investigation.

On the same date a circular letter was sent to all graders-in-charge and cheese instructors asking the former to report on the methods of handling at cool stores, and the latter to pay special attention to the handling in the factories

HANDLING OF CRATES.

A survey of the replies received from the grading ports did not disclose any marked difference in the methods of handling. If there are any weak spots, they are more or less common to all. They are—Dropping of the third tier of crates which are lying on their sides in the railway-truck when starting to unload, and dropping the top tiers in the cool stores, which are up to six high, when breaking out a straight face in a stack when loading out. The latter seems to be the weakest spot in the chain of handling in New Zealand.

Special conditions obtain at some ports regarding shipment. Patea cheese is transhipped in Wellington, either from coastal steamer to Home steamer or from coastal steamer to Harbour Board store, and thence to Home steamer. Shipments of cheese from the Bluff during 1936 totalled 33, Wellington 81, Patea 68, New Plymouth 45, Wanganui 36, Dunedin 24, Auckland 66, and Lyttelton 24. Cheese in the Bluff cool stores would therefore have a long storage period before shipment, the crates being on the same end without turning during that time, and it has been suggested that this treatment might encourage huffing, but Wellington, which is next for the number of complaints, has the most frequent shipments. It has also been noticed that practically all the cheese about which complaints of mould penetration were received at the Bluff were waxed.

In connection with Auckland, it is perhaps worth noting that the greater portion of the cheese shipped from that port is made in factories in which the temperature of the curing-rooms is controlled by artificial refrigeration.

Points covered by instructors regarding possible causes of mould penetration deal with the need for close rinds, and mention the following points: Space not covered between bandage and cap; loose bandages caused by not pulling them up at dressing; handling of green cheese.

TIME OF DRESSING.

A point was also raised regarding the dressing of cheese in the morning instead of the evening This practice is said to have increased recently in order to avoid paying overtime, with the result that owing to scalding water not being available at the time when the work is being done in the morning, and the short period of pressing after it is finished, no proper rind is developed on the crown. As the general practice is to "size" or cut down the cheese at this stage the cap and bandage do not adhere to the crown, and cracking and mould penetration results.

The Dairy Research Institute could not conveniently undertake any experimental work on this subject at this stage, and with a view to getting some further information on the question of the effect of the treatment which the cheese receives during handling it was decided to take advantage of Mr. Robertson's return from London, and arrangements were made for this to be done at New Plymouth during September, 1936. The suggestion was that five crates of open cheese and five of close cheese should be purchased and put through various treatments, and be examined by cutting each cheese into two halves some months later.

Some of Mr. Robertson's comments when the suggested scheme was put before him were as follows :—

> "The amount and nature of the handling no doubt plays an important part in inducing mould-growth, but mould penetration in cheese seen in London, whether in English, Canadian, or New Zealand, was by no means confined to open cheese.
>
> "There are several types, the most common being that which gains access through cracks in the end of the cheese. Then there is the type caused by the end lifting off, and this is seen as often at the bottom as at the top of the cheese."

The ten crates of experimental cheese were received at Moturoa grading stores on 13th October, and during November a single cheese, which was received there with a crack round the lip, was purchased, as it bore indications that the end would lift off.

Commenting on this cheese, Mr. Robertson says, " Many close cheese will puff up, and the only sign of defective body is seen where the break takes place. On the other hand, many cheese with split texture also puff up, so there may be some connection between the two. The whole trouble arises when the fracture extends to the rind and allows the admission of air, as without this no mould development can take place. From what was seen in Great Britain I would not say that open cheese were any more liable to this particular defect than close cheese."

The following details give the treatment to which the cheese were subjected, and the results :—

EXPERIMENT TO DETERMINE THE INFLUENCE OF HANDLING ON MOULD PENETRATION IN CHEESE.

Ten white cheese were purchased from a dairy company which was making close cheese Cheese made 14th October, 1936

Ten coloured cheese were purchased from a dairy company which was making open cheese Cheese made 12th October, 1936

Cheese were received at the grading-works, Moturoa, on 13th October, 1936; packed, 29th October, 1936, stacked on ends till 10th December, 1936; stacked on sides till 18th February, 1937

Examined at Wellington, 19th April, 1937 Age approximately six months

One cheese with a cracked lip was purchased from another dairy company on 15th November

All cheese was forwarded to Wellington by rail on 18th February and received on 22nd February Stacked on ends till 19th April, 1937. Treatment of cheese was as follows · Turned daily until crating on 20th October Crates 1, 3, 5, and 7, cheese packed with bottoms to centre board; crates 2, 4, 6, 8, and 10, cheese packed with tops to centre boards

Marks.	Treatment on Shelves and during Packing.	Treatment of Crates	Remarks.
Group 1: Crates 1 and 2—			
Crate 1—Cheeses No 1 white and No. 1 coloured Crate 2—Cheeses No 2 white and No. 2 coloured	Handled carefully at all stages . .	Crates stacked on end for six weeks without turning and a further ten weeks on sides	1W No visible fractures in rind 1C Cracked ends · one over 1 in deep 2W Sound rind 2C Cracks on sides
Cheese No. 2 (coloured) showed a bare patch when received due to inefficient dressing			
Group 2: Crates 3 and 4—			
Crate 3—Cheeses No 3 white and No. 3 coloured Crate 4—Cheeses No. 4 white and No. 4 coloured	Handled carefully up till crating, and then treated roughly by letting crates fall to floor	Crates stacked on end for six weeks without turning, and a further ten weeks on sides	3W Cracks on sides 3C Small cracks on sides 4W Good sound rinds. 4C Fracture in end
Cheese No. 4 (coloured) had a nail puncture and also a loose cap when received			
Group 3: Crates 5 and 6—			
Crate 5—Cheeses No. 5 white and No. 5 coloured Crate 6—Cheeses No. 6 white and No. 6 coloured	Handled carefully at all stages. .	Crates stacked on end and turned carefully each week for six weeks, then stacked on sides for a further ten weeks	5W Good rinds 5C Good rinds 6W Small cracks in sides. 6C Small cracks in sides.

EXPERIMENT TO DETERMINE THE INFLUENCE OF HANDLING ON MOULD PENETRATION IN CHEESE—*continued*

Marks.	Treatment on Shelves and during Packing.	Treatment of Crates.	Remarks.
Group 4 : Crates 7 and 8— Crate 7—Cheeses No 7 white and No. 7 coloured Crate 8—Cheeses No. 8 white and No. 8 coloured	Handled roughly during turning, and dropped on ends on shelves	Crates stacked on end and turned roughly each week for six weeks, then stacked on sides for a further ten weeks	7w Closer than previous lots ; very fine cracks in sides 7c Closer than previous lots ; very fine cracks in sides ; nail in lip 8w Closer than 7w , long fracture in lip, apparently a cut 8c Closer than 7c very small cracks in sides
Group 5 : Crates 9 and 10— Crate 9—Cheeses No. 9 white and No. 9 coloured Crate 10—Cheeses No. 10 white and No. 10 coloured	Handled roughly and treated similarly to 7 and 8 Treated as above and dropped on floor from height of 3 ft	Crates dropped to floor from one tier high, stacked on end for six weeks without turning, then ten weeks on sides	9w Similar to 7w. 9c Closer than 7c ; sound ends and sides 10w Closest cheese of whole experiment ; number of large cracks in rinds. 10c Some large cracks in rinds and lip, with a strong growth of mould for a short depth only.

Crate with one cheese with cracked lip . Large number of mechanical openings , bottom more open than top ; loose top but not completely detached from rind ; large fracture in lip . break in rind on side , no mould penetration.

GENERAL OBSERVATIONS.

There was practically no mould development on the rinds. The bottom halves of all the cheese were more open than the top halves, more particularly in the white cheese.

Ends next to centre boards were in all cases softer than the opposite end, whether the cheeses were resting on the centre board or not during the period in stacks.

Grading-points of all cheese white and coloured :—

White—Flavour, 40½ ; body, 18 ; closeness, 18½ : total 92.

Coloured—Flavour, 41 ; body, 18½ ; closeness, 18 : total 92½.

White cheese bitter, and flavour not characteristic of cheddar.

Coloured cheese more desirable cheddar flavour.

Body of white cheese not so silky as coloured.

Openness of coloured cheese was more marked than in white cheese, but was of a slitty character compared with fractures in the latter. It was more evenly distributed.

Crates 7 to 10 progressively closer than previous crates.

Rinds in all cheeses except 1c and 8w in good condition, particularly white cheese.

No mould penetration in any cheese except 10c.

CONCLUSIONS.

Rough treatment was not sufficient to cause fractures in rinds, and cheese so treated were rather closer than carefully treated cheese

The absence of mould in 8w and the single cheese purchased indicates that the conditions under which they were held were not conducive to mould-growth. The same defects under favourable conditions for mould-growth would probably have resulted in mould penetration.

This definitely points to the necessity of improved conditions in some curing-rooms, cool stores, ships' holds, and storage warehouses, but does not suggest that rough handling is permissible.

There are a number of points which are of interest—for instance, the more open character of the bottoms than the tops. This seems to indicate that the pressure in the press is not exerted evenly throughout the whole depth of the cheese

It is not difficult to understand why the ends of the cheese which were resting on the centre boards should be soft, but it is difficult to see why the end of the cheese in the bottom section of the same crate and not in contact with the centre board should be soft also. This has been noticed in the grading-stores in cheese held awaiting shipment.

The openings in the coloured cheese were of an entirely different character from those in the white cheese, being small slits fairly evenly spread over the cut surface. Those in the white cheese were fractures which extended from side to side of the cut surface, and would lead one to expect mould seams to develop readily if the rinds were defective and the atmosphere favourable to its growth.

That would appear to be the determining factor which decides whether mould-growth takes place or not. The shallow but heavy growth of mould in No. 10c indicates that there was no lack of mould spores in the rooms in which the cheese was held, but its absence in

8w, which had a deep cut in the edge, and in the single cheese, which had a fracture right across the cheese at the top end, indicates that it can be controlled.

EFFECT OF TREATMENTS.

The object of the handling to which the cheese were subjected was to indicate the effect of various treatments :—

Group 1 : Careful handling in the factory and during transport.
Group 2 : Careful handling in the factory and rough treatment during transport under ordinary stacking conditions.
Group 3 : Careful handling at all stages plus careful turning each week in store.
Group 4 : Handled roughly in factory plus rough turning each week in store.
Group 5 : Handled roughly at all stages.

All crates were stacked on their sides from 10th December, 1936, to 18th February, 1937. After arrival in Wellington they were stacked on end so that conditions in this respect would be the equivalent of grading-store conditions in New Zealand, on shipboard, and in store in Britain.

As the result of the various treatments outlined, one would have expected the latter groups to show more rind defects and more openness than the others, but such was not the case.

It is probable that had this experiment been carried out at an earlier or a later stage when moist conditions prevailed there would have been more mould growth and penetration.

The evidence available supports Mr. Robertson's statement that there are two types of mould penetration ; one which gains access through the detachment of either the crown or the bottom of the cheese and the other due to smaller fractures or cracks in the rinds, ends, or rims.

The evenness of the break in the first type gives support to the theory that it is due to huffing, as the fracture, when it takes place at the crown usually follows the concave lines which appear in all cheeses when cut in half. It can be readily believed that the factor which determines whether the top or the bottom of the cheese will become detached is the position which it occupies in the crate. It is possible that a fracture in the rim may act as an outlet for the gas which is responsible for huffing, but rough handling subsequent to huffing is the probable cause of the complete detachment of the end afterwards.

Huffing, while on the shelves, was at one time common, but it is seldom seen to-day, and there is no evidence to show the stage at which it developed in the cheese which were the subject of complaint.

Penetration of mould through smaller defects in the rind can obviously result from a number of causes such as those noted on some of the cheese in the experiment, provided the storage conditions are favourable to its growth. Its absence in these cheese is an indication that it is possible to prevent its growth, and improvement in the conditions in the curing-room suggests itself as the first point requiring attention.

On 10th February, 1937, a circular letter was sent to all cheese instructors asking for information regarding factories :—

(1) Which have built new curing-rooms ; and

(2) Which have improved the ventilation, air circulation, and humidity control in existing curing-rooms ;

Also any action taken in regard to—(*a*) The necessity for close rinds and crowns ; (*b*) clean vat-covers.

Replies indicated that thirteen new factories or curing-rooms provided with good ventilation had been built during the previous year, and that improved ventilation had been provided in thirty-one others, while humidity had also received attention. These numbers have been considerably added to during the present winter.

In his reply, Mr. J. H. Earl, Dairy Instructor, Hamilton, indicated that only five of the twenty-six curing-rooms in the Auckland District were not provided with refrigerators.

Other points dealt with were the necessity for washing and drying the shelves after the cheese are removed for packing, fumigation with sulphur and formalin, while comment was made on the use of the curing-room as a general lumber room.

(The provision of a room for the storage of bandages and capes is a noticeable feature of many of the plans of new cheese-factories recently received for approval at this office.)

Points dealt with in connection with rinds and crowns were—Care in filling the hoops and sizing at dressing to ensure adequate pressing, scalding of hoops, quality of cheese-caps, lapping of cap and bandage, oversalting of curd, and draughts playing on cheese on the shelves causing cracked rinds. These are all possible causes of defects in the rind which will give access to mould, and, though commonplace points, their inclusion indicates that they have been noted in some factories.

The course of action to be followed in the future appears to be along the lines followed in the past in regard to supervision in the factories, and as the time seemed opportune to make even greater efforts to impress these points on factory managers and directors with a view to providing improved conditions in curing-rooms, a further circular letter dated 7th July, 1937, was sent to all dairy companies manufacturing cheese in New Zealand suggesting the means to be adopted to achieve this end.

An interesting experiment has been carried out on a South Canterbury farm. On two fallowed fields in February, 1935, drill widths of carbonate of lime were sown—one at 5 cwt. per acre, two at 10 cwt., three at 15 cwt, four at 1 ton, five at 30 cwt., and six at 2 tons. Field A was sown in March, 1935, with 30 lb. perennial rye-grass and 5 lb. red clover, with 1 bushel of oats, which were fed off during winter. Field B was sown in September, 1935, with 20 lb. ordinary rye-grass and 6 lb. of red clover, with oats, which were cut for crop. The results in these two fields show remarkable differences On field A no results from any treatment can be seen; on field B the response of the red clover from lime is outstanding, even 5 cwt. giving a good result. The autumn sowing has formed a dominant perennial rye-grass sward. The spring sowing has formed a dominant red-clover sward. The clover has responded to the lime on field B, whereas on field A the clover content is practically non-existent.

—*Fields Division.*

TROUBLES ASSOCIATED WITH THE FEEDING OF ROOTS.

D. MARSHALL, Veterinarian, Hamilton.

IN many parts of New Zealand the use of roots is standard practice in the winter feeding of cattle, sheep, and sometimes pigs. It is recognized that mangels and turnips consist largely of water. Henry and Morrison give the composition of swedes as water 89·1 per cent., ash 1 per cent., crude protein 1·2 per cent., carbohydrate (including 1·4 fibre) 8·4 per cent., and fat 0·3 per cent. Mangels are almost identical. These foods are therefore low in protein, their chief food value consisting in the carbohydrate.

Before mangels are fed it is essential that they should be lifted and properly pitted for at least a month to six weeks in order that they may mature and certain chemical changes take place. Swedes and turnips may be lifted and pitted, or at least carted off and fed on grass paddocks. This entails considerable labour, and more often sheep or cattle are fenced on a portion at a time of the turnip crop, preferably with a good run off on to grass or rough feed.

There is discussion as to the value of roots in milk-production. In the Waikato soft turnips are valued by some farmers as a supplement during dry summer months, and are believed to keep cows milking. Their succulent nature is valuable at this time. For winter feeding, Boutfleur, of the Harper Adams College, considered roots too bulky as a feed for high-producing dairy cows. He is, of course, a great advocate of a concentrated diet. Other writers, however, consider that roots, up to a point, and properly balanced with other food, will increase milk-production. The average amount fed to dairy cows is up to 56 lb. Bullocks can be run on turnips alone, and will fatten. Dairy cows, however, whether dry and pregnant, or in milk, will not stand this treatment, and additional food is required. Apparently hay is quite a suitable supplement, as it assists amongst other things in providing fibre to allow rumination to be carried out properly.

Where a run-off is provided, this is not of much value unless a fair amount of rough feed is available. Ewes are sometimes run on turnips right up to lambing, but, while no ill results may follow, the practice is a risky one unless a good run-off with a fair amount of roughage and picking is available. Cases of ante-partum paralysis have been seen in ewes on turnips where this precaution was ignored.

In the winter feeding of pigs, roots are useful. Recent information available to the Fields Division at Ruakura indicates that the quality of bacon was improved considerably by including swedes up to 30 per cent. of the ration of pigs, compared with a ration of milk and grain only. The experiment was carried out by Professor Jesperson, of Copenhagen, and it was found that, whereas on the skim-milk grain ration alone only 5 per cent. carcasses reached first grade, pigs gaining 1·6 lb. a day, there was a steady increase in the percentage of first-grade carcasses with an increase in roots until, in the pigs getting 30 per cent. roots, 75 per cent. were graded first, though the daily rate of gain was slightly reduced to 1·1 lb. per day. Mr. Ballinger is carrying out a similar experiment at Ruakura to check results under New Zealand conditions.

It should be remembered that, owing to their low protein content, roots alone are not a sufficient food for young growing pigs or for pregnant sows, and should be balanced with a good protein supplement such as meat-meal or good-quality grain-meal.

MORTALITY DUE TO MANGEL FEEDING.

Mr. B. C. Aston, till recently Chief Chemist to the Department, did considerable investigation of the mortality due to mangel feeding, and as far back as 1911 wrote an article on the subject in this *Journal*, dealing with mortalities in cows at that time. It was his opinion that the poisoning—for such it appears—is due to the formation of nitrites from nitrates in the stomach. The amount of nitrates present is high in certain seasons.

Two years ago mortality occurred in a farm in the Bay of Plenty. The mangels were pulled and left lying in the paddocks, not heaped or pitted, for about a month before using. Though this was the farmer's usual practice, it was evidently not sufficient for proper curing to occur. A load was carted out to in-calf cows about twice a week—about 30 lb. per cow Mangels were put out one afternoon, and next morning eight cows were dead in the paddock. Nitrates in undue amount were present in the mangels.

Two occasions occurred more recently in which a number of deaths occurred suddenly amongst pigs being fed mangels. The deaths suggested poisoning, but analysis for the common poisons were quite negative, while analysis of mangels revealed nitrates present in more than normal amount. It should, therefore, be realized by farmers that, while mangels are an excellent winter foodstuff, there is risk in their use unless they are properly matured by pitting for some weeks.

One point to be noted in the feeding of any variety of turnip to the dairy cow is that these may give the milk a very strong turnipy odour and taste. This is particularly evident if cows are running all day on turnips and eating shaws and all. It is due to elimination of certain volatile substances by way of milk. It can be largely avoided by feeding the turnips, minus the tops, immediately after milking, and to a less extent by letting the tops wilt before feeding. It is almost unescapable if cows are on turnips all day.

REDWATER.

In the United States of America, South Africa, Queensland, parts of Britain, and Ireland, a type of redwater occurs due to the presence in the blood of a small parasite which attacks and breaks down the red blood cells. It is transmitted by ticks. However, there occurs also in Britain a form of redwater not known to be associated with parasites and called parturient redwater, because of its common occurrence after calving. It is apparently this form which occurs in New Zealand. So far no parasite has been detected in the blood, and also it occurs in parts of the country where ticks are not found. It is believed to be dietetic in origin. It is common in Otago and Southland, often appearing about ten days after calving, and nearly always associated with root feeding. A common history is that cows have been on roots and hay and for some reason the hay ration had been omitted, though the usual supply of roots was eaten. Redwater appears in about twenty-four hours. In the South Auckland district, it has been seen both in pregnant dry cows and milking-cows under above conditions, or where running on turnips alone, with a poor run-off. It is also sometimes seen about October in the Bay of Plenty in cows on grass.

Symptoms.—The urine, if seen, is characteristic, and is any shade from bright red to almost black coffee colour. The mucous membranes lining, eyelids, mouth, nostrils, and vagina are pale and blanched. The heart-beat is loud and the impulse easily felt at side of chest. Cow may continue to feed and milk for a day or two, and, if early symptoms are overlooked, death occurs with apparent suddenness. However, there is usually a period of extreme depression, weakness, and loss of appetite for a day or two before death. Post-mortem will usually show black urine in bladder, and kidneys dark, almost black.

Treatment.—Owing to oxygen shortage and heart weakness the animal is in a critical state, and should not be unnecessarily driven or hustled. Drenching also should be carried out with great care to avoid pneumonia, which is a common result. Cow refuses to swallow, and the drench enters lungs instead of stomach.

Salt is an old and usually effective remedy. Give ¾ lb. to 1 lb. properly dissolved in a quart of tepid water, with 1 tablespoon of baking-soda and 1 lb. molasses, carefully as a drench. Rug well, leave quiet, and if animal is still feeding, give plenty of hay sprinkled with molasses. If animal is off feed, stimulants may be given, such as 1 teaspoon of powdered nux vomica and 1 oz. of vegetable turpentine in a bottle of milk, or a bottle of beer. If a case of redwater appears, immediately adjust feeding for balance of cows, reducing turnips and giving adequate hay.

TURNIP SICKNESS—TURNIP FOUNDER.

These names are loosely given to a derangement occurring in dairy cows very often dry and pregnant, under same conditions as produce redwater—unlimited roots with little or no supplement.

Symptoms.—There may be marked stiffness suggesting rheumatism, or the gait of a foundered horse. The animal may stagger. In more severe cases, cow may go down and have difficulty in rising. The expression is dull, the pulse weak, appetite gone. There is a desire to drink, and excessive quantities of fluid make the trouble worse. The paunch is frequently distended with fluid and fragments of turnip, and the animal has a full appearance.

Treatment.—This should be prompt. Two tablespoons each of common salt, ginger, and baking-soda, with 1 lb. molasses, should be given at once. This may be all that is required. Stop roots for a day or two and feed hay. In more severe cases nux vomica, soda, and molasses should be given in repeated doses (1 teaspoon powdered nux vomica, 1 tablespoon of baking-soda, 1 lb. molasses, twice a day). As with redwater, immediately correct feeding for balance of herd.

CHOKE.

This is more likely to occur in stall-fed animals than in the field. A portion of a root slips over the throat and becomes lodged in gullet, very often about the middle of the neck. The animal coughs, slobbers, and stops feeding. The immediate danger is that the gullet is impacted, gas is unable to escape and bloating occurs, threatening suffocation. It is sometimes, therefore, advisable to use trocar and canula, and leave latter in position in the left flank. In some cases the cow will then herself get rid of the obstruction. If just at back of throat, it may be possible to reach the obstruction by putting a hand into the mouth, remembering the risk of getting one's fingers chewed.

A probang may be cautiously used, if available, or failing that a piece of flexible branch or whiphandle, with a piece of cloth in the shape of a knob securely placed to the end, and the whole well greased. The cow's head should be extended in line with body and securely held by a man on each side before this is attempted. On no account try to push down a rigid stick such as a broomhandle or a piece of steel bar, as the gullet will certainly be punctured.

CITRUS INDUSTRY.

The area devoted to both orange and lemon culture in the Dominion is steadily increasing. In comparing the figures set out below with those which appeared in the *New Zealand Journal of Agriculture*, Vol. 53, No 1, page 49 (July, 1936), it will be seen that during the past twelve months, while there has been a decrease of forty registered growers, there has been a gain of 10,240 citrus trees.

From the orchard-registration records the following Table 1, showing the number of registered citrus-growers in the Dominion classified in districts according to size of orchard, as at 1st October, 1936, has been prepared –

Table 1.—Showing the Number of Registered Citrus-growers in the Dominion classified in Districts according to Size of Orchard as at 1st October, 1936

Group, Number of Trees ..	1–50 Trees.		51–350 Trees.		351–1,000 Trees.		Over 1,000 Trees.		Total of Trees
District.	Number of Growers	Number of Trees.	Number of Growers	Number of Trees.	Number of Growers	Number of Trees.	Number of Growers	Number of Trees.	
Whangarei ..	200	2,384	63	9,872	40	20,400	3	6,553	39,209
Auckland	739	10,762	261	32,473	19	9,231	1	1,350	53,816
Hamilton	151	869	6	551	..	..	..	..	1,420
Tauranga	246	2,752	99	15,693	20	10,320	2	3,322	32,087
Gisborne	183	1,816	22	3,006	1	420	..	..	5,242
Hastings	201	1,845	19	2,276	..	..	..	..	4,121
Masterton	13	70	..	..	..	..	..	..	70
Palmerston North ..	218	1,204	3	267	..	..	..	..	1,471
Wellington ..	24	141	..	..	..	..	..	..	141
Nelson	56	381	14	1,559	1	450	..	..	2,390
Mapua	36	319	7	520	..	..	..	..	839
Motueka	66	385	6	563	..	..	..	..	948
Blenheim	93	369	..	..	..	..	..	..	369
Christchurch ..	23	51	..	..	..	..	..	..	51
Dunedin	2	13	..	..	..	..	..	..	13
Trees	..	23,361	..	66,780	..	40,821	..	11,225	142,187
Growers	2,251	..	500	..	81	..	6	..	2,838
Percentage of total number of growers	79·32	..	17·62	..	2·85	..	0·21	..	..

Table 2.—Lemon and Orange Trees in Registered Orchards as at 31st October in the Years 1934, 1935, and 1936.

Kind of Fruit.	1934.	1935.	1936.	Percentage Increase 1936 over 1934.
Lemons	85,973	91,032	96,034	11·7
Oranges	37,399	40,909	46,153	23·4
Totals	123,372	131,941	142,187	15·3

—*W. K. Dallas, Acting Assistant Director of the Horticulture Division.*

SURVEY OF CERTAIN CROP DISEASES IN CANTERBURY AND NORTH OTAGO.

I. D. Blair, Canterbury Agricultural College, Lincoln.

With a grant of the Plant Research Committee, a crop-disease survey was made from December to March, 1936–37. The area covered included all county areas from Amuri in the north to Waitaki in the south, and the distance travelled was 2,500 miles. As this was the first complete survey of such a nature it was decided that primarily it should be in the form of a reconnaissance. Undoubtedly the problems of determining the factors which predispose crops to certain diseases require investigation, but it was considered that first of all a knowledge of the occurrence, distribution, and extent of infection was necessary. Following upon this definition of the areas, if any, where certain diseases were widespread and severe, one would then be able to determine which aspects of the disease problem might require further study. Thus throughout the course of the survey the crops were merely inspected and estimates made of the extent of infection of certain diseases. Little attention was given at this stage to an examination of possible factors which may have been associated with a severe or slight infection.

In view of the time of the year during which the survey was made the only diseases studied were such as occur in maturing crops of wheat, oats, barley, peas, lucerne, red clover, white clover, cocksfoot, and rye-grass.

The following is a summary of the position concerning the cereal crops alone, the complete details of which are published elsewhere :—

OATS.

(1) *The Smut Diseases.*

The position with regard to the occurrence of loose smut (*Ustilago avenae*) and covered smut (*Ustilago Kolleri* and *U. laevis*) in oats is shown in the following table. The percentage of smut infection was determined by counting ten five-yard coulter samples at random throughout the field, except where it was obvious that there was no more than a " trace " of infection :—

Table I.—A Summary of the Degree of Smut Infection in Oats.

—	Algerians.	Gartons.	Other Varieties.
Total number of crops examined ..	121	69	30
Unaffected (per cent.)	60	63	47
" Trace " (per cent.)	20	27	5[illegible]
" Severe " infection (1–20%), (per cent.)	20	10	13

This table is a summary of a table in which the detailed distribution of the smut diseases is recorded.

During the survey it was found that covered smut of oats (*Ustilago Kolleri*) was much less common than loose smut (*Ustilago avenae*).

These diseases are widely distributed, but no more severe in one district than in another. From Table I it will be observed that, according to variety, from 37 per cent. to 63 per cent. of the oat crops were affected with smut and from 10 per cent. to 20 per cent. were severely infected. From the figures given above, Algerians appear to have been more severely affected than Gartons. This is believed not to be a varietal difference, but to be due to the common practice of sowing unpickled Algerian seed, primarily for green feed. Later such crops may be allowed to go to seed and the infection with smut is then apparent.

The severest infections occurred with lines of unpickled seed. Most of the unaffected crops had been sown with disinfected or pickled seed, but instances have been recorded of smut-free crops grown from unpickled seed. Mr. J. C. Neill in 1926 concluded that oat smut destroyed 600,000 bushels in the South Island, an estimated loss of £135,000.

Apparently the disease has been reduced since 1926 as a result of the greater use of seed disinfectants since then. Thirty-five per cent. of the growers visited during this survey did not pickle their seed-oats, and it is those crops which are acting as centres of infection from which the diseases spread. It appears that there is a possibility of freeing oats from infection with smut if all growers pickle the seed.

In the following table an indication is given of the proportions of various seed pickles used for oats in the area under investigation :—

Table II - The Proportions of various Disinfectants used with Oats

Seed Treatment used	Number of Growers.	Percentage
No treatment .. .	96	35·0
Ceresan .. .	50	18·2
Agrosan	30	10·9
Copper carbonate .	16	5·8
Clark's	24	8·7
Formalin	36	13·1
Bluestone	22	8·0

(2) *Rust in Oats.*

Leaf-rust (Puccinia coronota) was widespread, but the disease was not "severe," except in three localities—viz., Kowai, Ashburton–Methven, and Ashburton Main.

Stem-rust (Puccinia graminis avenae) seemed to be more "severe" in effect where it occurred, but it was not so widely distributed as leaf-rust early or late in the season. It was "severe" in spring-sown crops of oats throughout all districts. Wherever leaf-rust was found as a heavy infection, stem-rust was also "severe." Thus in the Kowai County, particularly at Amberley and in Ashburton Main and Ashburton–Methven, there were heavy infestations of both rusts early in December. In all other districts stem-rust was not reported until late in January, and then only as a "trace" or "moderate" infection. In view of the heavy leaf-rust infection in the three districts mentioned and the early attacks of stem-rust there, such areas appear to have been centres of infection this year. Whether or not they or other districts may be recorded as rust-susceptible areas can only be proved by observation in succeeding years.

Further observations on the occurrence of rust will be made in connection with barley and wheat.

(3) *Other Disease Conditions in Oats.*

Mildew was not present this year in any of the 220 oat crops examined during December and March.

Red Leaf.—The vivid red colour of the lower leaves of oats draws frequent comment each year. In America Sprague found that the condition was most prevalent in poorly drained soils where there was excessive water and a decreased oxygen-supply. Unduly luxuriant top growth as a result of the lengthy vegetation season is also apt to induce lead-reddening.

This condition appears to be due to some physiological cause. During this survey it was found in all districts and in all varieties but more severely in Algerian oats. Although it was more common in soils which seemed to be poorly drained and was characteristic of autumn-sown crops, some severe attacks have been recorded in crops grown on the very best open-textured soils. It was also frequent on light and sandy soils, in which case excess of water and poor drainage would not be associated factors. The cause and effect of this condition require some investigation.

Blindness in Oats.—All crops were affected in some degree with a condition characterized by sterility and whiteness of some of the spikelets. O'Brien and Prentice describe such a condition in Scotland as being due to attack of *Helminthosporium avenae*, which also causes death of seedlings. This condition in oats requires investigation under New Zealand conditions, for in some instances the sterility of the ears was as great as 75 per cent. Usually the affected ears are distributed throughout the field, but in three instances patches of the crop with heavy infestation of blind ears were observed.

BARLEY.

The barley crops in the area under survey were confined to three districts. The position has been examined under the heading of " district " rather than " disease."

(1) In the North Canterbury district only one crop of Spratt-Archer Barley was examined. It was " severely " affected with leaf-stripe (*Helminthosporium gramineum*). There was only a trace of leaf-rust (*Puccinia anomala*) and mildew (*Erysiphe graminis hordeae*).

(2) In the Ellesmere barley-growing district ten crops of Spratt-Archer, four of Chevalier, and two of Cape Barley were examined. All these crops were free from loose smut (*Ustilago nuda*). The hot-water seed treatment introduced by the Canterbury (New Zealand) Seed Co. has evidently resulted in this disease being controlled completely. The position with barley is much more satisfactory than will be shown to be the case with the wheat crops. In Ellesmere barley crops grown from seed, four years removed from the hot-water treatment, were found to be still free from loose smut. There was no evidence of covered smut (*Ustilago hordeae*) in these crops, the seed of which is treated each year with Ceresan.

Leaf-rust was widespread throughout Ellesmere, all the crops and varieties being infected in "moderate" or "severe" degree. On the other hand, stem-rust (*Puccinia graminis hordeae*) was rare and occurred only in "traces," as revealed by an inspection six weeks after the estimates were made of leaf-rust. During this season there was no correlation between the degree of severity or the occurrence of leaf-rust and stem-rust in barley as has been suggested in the case of the two rusts of oats.

The ten Spratt-Archer crops were affected with leaf-stripe, five of them revealing "severe" infection. The four Chevalier crops were much less affected and showed only a "trace" of stripe. Cape Barley also revealed only a "trace." The stripe disease is apparently reduced by the seed hot-water treatment. There was no sign of the disease in the crops directly removed from the treatment, while crops grown from seed once or twice removed were the ones which showed a "trace" of stripe.

Mildew was present in "traces" in all varieties.

(3) In the Waimate barley-growing district smut was more common. This was especially so in the six crops of Cape Barley, all of which showed a "trace" of covered and loose smut. In the Chevalier variety the two smuts were recorded as "traces" in two of the four crops inspected. Few lines of barley-seed in this district have been hot-water treated during the past three years. Leaf-rust in this district was not so severe in the barley crops as in Ellesmere. There was no more than a "trace" of infection in about 20 per cent. of all the crops of barley. There were "moderate" infections with leaf-stripe, while mildew was not recorded in any of the crops.

WHEAT.

(1) *Loose Smut (Ustilago tritici).*

"Traces" of loose smut were found in all districts. Estimates of infection were determined in the same manner as in the case of smut in oats. An infection over 0·4 per cent. is considered "severe" though the actual loss in yield resulting from such an infection might not be noticeable. On this basis the extent of "severe" infection in the varieties was determined as follows:—

Tuscan	9·4 per cent.	Garnet ..	20·0 per cent.
Dreadnought ..	5·4 per cent.	Cross 7 ..	22·0 per cent.
Velvet	11·5 per cent.		

This information is derived from a detailed table of the distribution and degree of loose-smut infection which is too lengthy to be published in this summary.

Estimates have been made also of the percentages of crops inspected which showed at least some degree of loose-smut infection. Over all the districts there was no infection whatever in the Hunters variety, but with the other varieties the following are the percentages of crops which were infected in some degree with loose smut:—

Cross 7	95·0 per cent.	Velvet ..	46·0 per cent.
Dreadnought ..	85·0 per cent.	Marquis ..	30·0 per cent.
Garnet	70·0 per cent.	Jumbuck ..	20·0 per cent.
Tuscan	58·0 per cent.		

From these figures a greater proportion of the Cross 7 crops were infected than any other variety, while the proportion of Jumbuck crops infected was lower than any other variety apart from Hunters. A considerable number of farmers are still under the impression that loose smut may be controlled by external seed-disinfection. They look upon the presence or absence of loose smut in the growing crop as an indication of the efficiency of the various seed steeps and dusts which have been used.

It seems that much more wheat should be hot-water treated to control loose smut. The practice of growing " home " seed, which is slightly infected, for years on end favours the spread or persistence of this disease. The length of time the treatment remains effective as a control seems to vary. In the case of Tuscan some lines four years removed from hot-water have been found to be quite free from the disease, while others become infected in the first year after treatment. Cross 7 is evidently more susceptible to loose smut than Tuscan, and the effectiveness of the hot-water treatment is not very lasting in the former variety. The extent of loose-smut infection has varied with the district. In Amuri and Waipara the infection figures were lower than in any other of the counties—*e.g.*, the percentages of the Tuscan crops in these two districts which were affected with loose smut were 25 per cent. and 14 per cent. respectively. These figures are compared with 87 per cent. infection in this variety in Geraldine, 78 per cent. in the Wakanui district of Ashburton, and 78 per cent. in the Levels County. In America loose smut of wheat or barley rarely occurs severely in the Pacific Coast States or in areas of that Continent where the relative humidity of the air is low at the time of flowering of these cereal crops. The low infection of loose smut in Amuri and Waipara, which are considered to be dry areas during November, supports the American experience that damp and humid weather at *flowering-time* is the only climatic factor favouring the spread of loose smut.

(2) *Covered or Stinking Smut of Wheat (Ustilago levis).*

It is possible that covered smut of wheat is to-day a disease of little importance throughout the wheatgrowing districts. The practice of seed-pickling wheat seems to have eliminated this disease. This opinion has been formed as a result of discussions with grain-merchants who handle large quantities of grain each year.

Dalgety and Co., Christchurch, during the past five years have had a number of infected lines, but the degree of infection was always very low. About five years ago the most severely infected sample was received containing 10 per cent. of diseased grain. The disease has varied with season and the type of land. In some seasons it is centred in the foothill districts—*e.g.*, Hororata, Oxford, Springfield. At other times Southbridge, Darfield, Dunsandel, and Chertsey have been areas from which numbers of infected lines have been received. Tuscan is the variety which has been most affected. It is concluded that over the past twenty years there has been a marked decrease in the amount of smutted wheat and barley due to (1) the fact that farmers change their seed more often and use certified seed ; (2) the increased use of smut-controllers such as Ceresan and Agrosan.

Canterbury Roller Flour Mills, Ashburton, receive samples of wheat each year showing traces of stinking smut. Pearl is the variety in which the trouble is most pronounced. Ashburton is not affected to any extent, smut occurring in isolated cases through carelessness in pickling or absence of dressing of any kind.

Wright, Stephenson, and Co., Oamaru, in the past five years have seen very few lines of wheat affected and have not been able to trace it in barley during that time. It has occurred principally in Dreadnought and Hunters. Since the treatment of wheat with Agrosan and Ceresan, smut has become insignificant. It is believed that where grain is stacked before threshing the ball smut is readily blown out in the threshing and not broken up, causing infection of the whole sample.

Proteena Milling Co., Ashburton.—Smut-infected lines received from Hinds, Laghmor, and Flemington. It is considered that the damage is slight, and infection has steadily diminished during the past ten years.

Fraser and Co., Dunedin.—The disease is not so prevalent as twenty years ago, when it was particularly severe in the Taieri district. Tuscan has been the most widely affected variety.

Canterbury Farmers' Co-operative Association, Ltd., Geraldine.—During seasons 1932–34 several affected lines were received, all Tuscan or Hunters. The worst cases were from Orari where farmers grew seed of their own saving which had been affected previously. It is considered that the consistent use of Ceresan is a definite deterrent.

Turnbull and Co.—During the past five years there has been a gradual decrease in the quantity of wheat affected. During 1935–36 no diseased lines were obtained.

From the above it is apparent that the position with regard to the externally borne smut-disease of wheat is much more satisfactory than has been indicated in the case of oats. But even though ball smut is eliminated from wheat it is wise to continue using the new organic mercury dust on account of the improved yields that are secured as a result of their use. Very few farmers use untreated wheat-seed. The following table shows the present position concerning the practice of pickling seed wheat. The figures given were derived from a questionnaire of 236 farmers in the area surveyed.

Table V.—The Use of Seed Disinfectants with Wheat.

Ceresan	30·0 per cent.	Clark's	15·2 per cent.
Agrosan	18·5 per cent	Formalin	16·4 per cent
Copper carbonate	9·0 per cent	Bluestone	10·7 per cent

Total dry dusts, 54·5 per cent Total wet pickled, 45·5 per cent

Ceresan and Agrosan are becoming very popular. Wet pickles are certainly being replaced and less of these are being used.

(3) *Mildew of Wheat (Erysiphe graminis tritici).*

Mildew has been found in all districts, but during this year seems to have been a disease which caused little damage to crops. The disease is not at all characteristic of the wetter districts as is generally believed. In the Waitaki County, where very dry conditions were experienced all through the past growing season, mildew in wheat was common. The severest attacks occur in dense crops on heavy land, but the disease has been recorded frequently on drier soils where the crops are thin and open. An estimate of the varietal differences was obtained in which the mean percentage of crops infected over the area investigated was calculated as follows:—

Tuscan	57·8 per cent.	Jumbuck	29·0 per cent.
Hunters	60·8 per cent.	Dreadnought	30·6 per cent.
Cross 7	39·3 per cent.	Velvet and Pearl	57·0 per cent.

In certain areas Cross 7 has exhibited a degree of resistance to mildew compared with other varieties. In three fields in particular—one in Waitaki, one in Malvern, and one in Ellesmere—Cross 7 and Tuscan had been drilled in two halves of the same field. In each of these cases the Cross 7 was quite unaffected, while the Tuscan in the other half of these fields revealed " moderate " infection. The difference between Dreadnought and Tuscan in the Waimate district was also notable. In this district mildew was rarely found even in traces in the Dreadnought variety. In all districts Hunters exhibited the greatest susceptibility to mildew, although Jumbuck often showed mildew infection of the green ears, which was rarely noticed with the other varieties.

(4) *Take-all of Wheat.*

In general, the term " take-all " has been used to describe a number of disease conditions. Strawbreak, whiteheads, and spring-yellows (a phase of foot-rot in which the plants are stunted as a result of fungus attack of the roots) have all been attributed to take-all. The true take-all disease caused by *Ophiobolus graminis* is characterized mainly by the presence of circular patches of stunted plants. The tillers of affected plants are covered with a black discoloration at the base. As Table VI shows, this phase of the disease was not recorded very frequently during the course of this survey.

Table VI.—The Occurrence of Take-all in Wheat.

Tuscan.		Hunters.	
Severe.	Trace.	Severe.	Trace.
1 crop (Springs). 1 crop (Kaiapoi). 1 crop (Amuri).	2 crops (Springs). 1 crop (Kaiapoi). 1 crop (Rangiora West). 2 crops (Levels).	1 crop (Springs). 1 crop (Kaiapoi) 1 crop (Rangiora East). 1 crop (Rangiora West).	1 crop (Rangiora East). 1 crop Waipara.

Garnet : 1 crop (trace), (Ashburton–Wakanui).
Velvet : 1 crop (trace), (Waipara).

In some districts during the past season, particularly in Rangiora East, Kaiapoi, and Waitaki, the presence of large numbers of bleached, sterile ears before ripening has caused concern among growers. Many of these attacks of whiteheads and strawbreak are considered to have been due to late attack by *Ophiobolus graminis*, which usually causes the stunted condition in autumn-sown wheat. It has been concluded that a number of whitehead conditions have occurred due to the following causes :—

(1) *Drought.*—In Waitaki most of the bleached, sterile ears were most likely due to this cause.

(2) Mechanical fracture of the tillers by insects, particularly weevil and hessian fly. The latter pest has been more prevalent than usual during the past season, one crop in Ellesmere showing at least 50 per cent. loss of tillers due to fracture caused by hessian fly.

(3) Whiteheads associated with a late spread of infection and attack by the take-all organism (*Ophiobolus graminis*).

(4) Whiteheads due to the rotting of the base of the tillers through attack by foot-rotting fungi (*Fusarium* spp.).

(5) *Diseased Ear Conditions in Wheat.*

Brown Chaff.—Cross 7 crops were affected generally with a condition characterized by brownish-black glumes and a black discoloration of the stem just below the ear. This was recorded rarely on other varieties. Work in America has shown that brown or black chaff may be due to bacteria (*Bacterium atrofaciens*), to fungi (*Alternaria* spp.), or the cause may be physiological in nature. In the crops examined during the survey the condition appeared to have no adverse effect upon the growth of the plants.

Wheat Scab.—At harvest-time there may be found a number of plants the heads of which are compressed, with tight and discoloured chaff. The spikelets are usually sterile or any grain formed is bleached and shrunken. During this survey such attacks of scab were never found in any degree. Traces were recorded in crops throughout all districts.

Blackheads.– Affected ears become grey-black in colour at maturity and are covered with spots of a sooty-black mould. The condition spreads rapidly while the crop is standing in stook, especially during a wet harvest. This disease has been shown by F. T. Bennett to be due to the organism *Cladosporium herbarum*, a fungus which develops mainly on mature crops during damp seasons and which is not directly parasitic, but spreads on plants which have been weakened by other causes.

During the harvest of 1937 this blackheads condition was reported frequently throughout North Canterbury. A severe storm early in December, 1936, caused many crops to lodge, and such damaged crops later revealed heavy infestation with *Cladosporium herbarum*, especially during the following January and February, when further wet conditions prevailed.

(6) *Rust in Wheat.*

The most widespread leaf-rust (*Puccinia elymi*) infections were recorded in Kowai, Malvern, and in the three Ashburton districts—Methven, Main, and Wakanui. Amuri and Waipara were almost free of leaf-rust infection. In no case during this season was leaf-rust so severe as to cause significant damage to crops. Differences in varietal infection have been calculated from the tables of the occurrence and degree of infection which have been prepared. From these tables the average infections of the varieties over all the districts were as follows:—

Tuscan	.. 61 per cent.	Velvet	.. 65 per cent.
Jumbuck	.. 66 per cent.	Cross 7	.. 64 per cent.
Hunters	.. 60 per cent.	Garnet	.. 63 per cent.

From the information which has been obtained there seems to be little difference in the varieties grown at the present time in respect to the extent of leaf-rust infection.

At the time of making the leaf-rust survey (December, 1936) little stem-rust (*Puccinia graminis tritici*) was noticed. At the end of January, 1937, all North Canterbury districts were inspected again. It was found that where leaf-rust had been recorded as "severe" during the first inspection—*e.g.*, Kowai, Malvern, and the three Ashburton areas—stem-rust was also present in the crops. Only in these districts were there any crops severely infected with stem-rust.

SEASONAL NOTES.

THE FARM.

The Coming Month.

GIVEN favourable weather, farmers as a rule are very busy during September. Indeed farmers who are not faced with more work than they can cope with conveniently in September either are particularly fortunate in having their work well forward, or, as is more likely, are not giving due attention to all the tasks that should be carried out. Successful farmers, while always alert to make the best possible use of all available time in September, do not allow their zeal in this respect to lead them into the error of carrying out cultivation work when the land is too wet—more harm than good readily results from working those soils which are at all heavy in texture when they are so wet that glazed furrows are produced in ploughing and that the soil clings to implements. There are in New Zealand extensive areas of open sandy soils which may be cultivated without harm to their texture when they are markedly wet, but, on the other hand, much of the land that is used for arable cropping suffers substantially if cultivated when in such an undesirably wet condition that it does not tend to crumble under the action of suitable implements. One immediate result of working overwet heavy soils is the appearance of clods when drying takes place, and it is usually both difficult and costly to reduce clods to a good tilth for cropping.

Provision of Special Feed.

The level of live-stock production that is to be attained both in the coming season and in the following one will be determined to a considerable extent by the manner in which farmers make provision of special forage for use during periods of scant pasture-growth. An important matter that deserves attention because of the frequency with which there is neglect in regard to it lies in the fact that pastures commonly fail as a direct source of feed for dairy cows much earlier in the summer than seems commonly thought to be the case, while many farmers devote all their attention to remedying February feeding weaknesses, actually pastures often begin to prove insufficient as early in the season as Christmas. Hence there arises a midsummer period of inadequate feeding to which little attention is given, but which is reflected in an unduly rapid decline in butterfat-production

Feed of a highly digestible non-woody character is required at this period. Young green lucerne following a first cut of the crop removed in good time, the leafy grass aftermath on a paddock from which silage was obtained at a suitably early date, and soft turnips of a quickly maturing type sown early are three sources of forage which may be successfully utilized in this connection. In planning the provision of special summer feed it is well to bear in mind that the season may be better than the average one, and that when it is so it is in the interest of economy of feed to be able to convert any surplus into hay or silage, and this it is impossible to do if the summer surplus consists entirely of such crops as rape and soft turnips.

A second matter calling for more attention than it receives is that the most marked feature of the normal provision of summer feed is its deficiency, not in quantity, but in quality: the stock often are given access to plenty of feed of a sort which is not the one that they particularly require. The three types of feed just mentioned—leafy lucerne, leafy grassland aftermath, and soft turnips—provide summer rations of suitable quality for dairy stock.

Feeding of Sidelines.

In planning the special cropping for the season provision should be made to meet the requirements not only of the main class of stock on the farm, but also of subsidiary classes such as pigs and poultry, on dairy-farms, and these together with cows on those farms on which grain or sheep are the main consideration Many farms on which dairy cows, pigs, and poultry are sidelines obtain very poor financial results from these sidelines because of the poor feeding of the sideline live-stock The present season of the year is the one in which to initiate steps to rectify this common weakness

For use in the winter period mangels, carrots, chou moellier, swedes, and turnips are all suitable. Except in the more severe and southern districts mangels give outstanding results when accorded good fertility and good cultivation They are markedly reliable, being practically free from attacks of any serious disease or pest ; they can withstand dry periods comparatively well, and under suitable culture their total yield of nutriment per acre is very high Because of these facts they are specially advisable on costly fertile land, and they should be grown more extensively than it has been customary to grow them As they require considerable attention, they should be located preferably in a position convenient to the homestead, where they are more likely to receive the weeding and cultivation that is essential to success than if they are grown in an out-of-the-way situation

As a rule swedes and turnips may suitably be grown instead of mangels when the farming is of a more extensive type, so that the standard of crop culture necessarily tends to be lower Carrots are suited to free soils on which, as Taranaki results in particular show, exceptionally good yields can be obtained without an unduly heavy outlay of labour With full justification chou moellier continues to be popular, and probably to grow in popularity for use on ground which is naturally fertile or which has been made so Chou moellier is especially suitable on land which is likely to be so wet at the time of feeding-off as to make the use of swedes wasteful Chou moellier is also very suitable when club-root is known or expected to occur in the land to be cropped Chou moellier though not immune to club-root is so resistant to it that good yields of chou moellier are obtained when swedes and turnips fail because of club-root infection

Lucerne should be grown to a much greater extent than it now is. While profitable results from lucerne are being obtained over a wide range of conditions of soil and climate, the most highly productive crops are, as a rule, on distinctly fertile soils A permanent vigorous crop of lucerne is of such great value that a fertile area should indeed be allotted to it Poorly drained conditions are to be avoided for lucerne Much information about lucerne culture is contained in Bulletin 155, obtainable free by applying to the Department of Agriculture. The success which attends the establishment of lucerne depends to a large extent upon the initial work. The initial steps in lucerne-growing should be based on the latest knowledge available, which enables many of the failures that characterized past efforts with lucerne to be avoided.

General Work with Crops.

Preparatory cultivation for both mangels and lucerne should be commenced soon, if it has not been started already. If at this stage it is proposed to plough old pasture for either of these crops, one deep ploughing will almost certainly give best results provided the furrows are well turned over so as to bury completely the surface layer which usually contains a big population of weeds or their seeds; these, if brought to the surface again by a second ploughing, would be likely to give trouble in the following crops.

Land for the potato crop which was skim-ploughed in the autumn should be ploughed deeply about September in preparation for the later cultivation needed to give a suitable seed-bed. In preparing the seed-bed it should be kept in mind that the potato thrives in a loose rather than in a compacted soil.

When cereal-sowing has been done the implements may suitably be kept at work on land in preparation for rape, chou moellier, and root crops. By cultivating such land in good time one most readily secures the type of seed-bed which is required—that is, fine from the bottom upwards.

It is often advisable to close up lucerne areas in September in order to obtain an early cut. An early cut is of twofold value: it removes plants which invade the lucerne to its detriment in the spring, and which do not appear prominently in subsequent growth during the season, and it gives much probability of an additional cut each year

Fields for Ensilage and Hay.

Pastures intended for haymaking and ensilage should be grazed off evenly and closed up as soon as they can be spared from grazing. Early closing of such fields is advisable, because it tends to lead to early mowing, which in its turn gives greater probability of a good aftermath that is generally very useful when the dry summer weather makes its effect felt. A top-dressing with superphosphate at closing-time of fields intended for ensilage or haymaking is often advisable especially in the case of fields not recently top-dressed. All material such as wire, timber, &c., likely to cause delays or breakages in mowing should be removed carefully from the fields prior to closing them.

Utilization of Feed.

Cows, during the early part of their milking-season, require feed relatively rich in protein; protein is required for the production of milk which contains proteins. Hay or silage made from pasture-growth that was at the flowering-stage or a more mature stage when mown is likely to be of low protein content unless clover was especially abundant in the herbage. The darker the colour of the silage the lower is likely to be its content of digestible protein, and it is the content of digestible protein which really matters—dark silage results usually from high temperatures during the ensiling process, and as the result of such high temperatures digestible protein tends to be turned into an indigestible condition Short leafy pasture-growth is relatively rich in protein—in fact, in some circumstances it may be excessively rich—but often in September the available supplies of it are insufficient to meet the needs of the herd. If it becomes necessary because of this to make hay or silage the main constituent of the diet of the herd, then it should be borne in mind that well-made clover and lucerne hays are relatively rich in protein. Failing such hays, silage or hay made from the leafiest pasture (if rich in clover so much the better) should be kept for use at this period. If the grass-supply is poor and hay and silage in unduly scant supply, it may quite well prove profitable to feed milking-animals some concentrates which are rich in protein, such as linseed cake, oats, or bran. If " bloating " occurs in cows grazing on short leafy pastures, the feeding of hay or silage is likely to be of value in lessening the trouble.

Seasonable Work with Pastures.

Whether top-dressing of established pastures in September is likely to be profitable depends to some extent on particular circumstances. If there is promise of an ample supply of growth for all requirements up to Christmas, including ensilage and haymaking, then the case for September top-dressing is not at all strong. But if additional growth for hay or silage production is required, then top-dressing in September of established pastures may be well worth while.

It is usually profitable to apply phosphates to a pasture at the time of sowing or shortly afterwards. Such top-dressing tends to provide the seedlings with greater vigour, which assists them in passing successfully and more quickly through the critical young stage.

Grass-harrowing in September is likely to be very advisable on those paddocks on dairy-farms on which stock have been held for winter feeding. It is especially desirable to harrow at this stage fields from which it is intended to harvest hay or silage during the coming summer —the harrowing should be done just before the time of closing-up.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Spraying Operations.

By the time these notes appear, growers will be considering their spray programmes for the coming season, consequently it is necessary to see that all appliances used in spraying operations are in good working-order. Too many growers are apt to neglect these precautions, and, when spraying should actually start, find that their spray-pumps, pipes, taps, rods, or nozzles need attention. In consequence much valuable time is lost Unfortunately for the grower, fungous diseases will not postpone development until all these defects are remedied Many instances could be cited where growers have been heavy losers by not applying the initial spray at the proper time.

Overhaul of Plant.

Therefore it is strongly recommended that all those growers who have not, up to the present, overhauled their plant do so as soon as possible, in order to get a good start at the right time The time of application of any spray is an important factor in the control of pests and diseases. Do not leave the ordering of the necessary materials until the last moment. It is better to have them stored in a shed ready for use than to be disappointed because the firm supplying the order is temporarily out of stock. Although spraying is an operation that the average orchardist does not look upon with any great favour, yet, if a good start is made with the first spray, future spraying not only appears easier, but growers are likely to secure more successful results.

There are quite a number of points to remember in successful spraying, and of all of them probably the most important are—(1) Proper plant; (2) proper materials; (3) proper time; (4) correct methods. All growers realize that no spraying can be successfully carried out without proper plant. Whether the plant be " stationary " or " portable ," it must be of sufficient power to cope with all emergencies that are likely to occur during the spraying-season.

Proper Materials.

The question of proper materials needs some explanation, and owing to the fact that the use of any but the proper specifics may result in heavy loss to the orchardist. It appears that too many specifics are being placed on the market, many of them not tested claiming to be a " cure all " for the numerous pests and diseases to be found in the orchard. Growers are strongly advised to consider fully the matter before venturing with a more or less unknown and untested spray, but to stick to those materials which have been thoroughly tested under all conditions, and known to give the best possible results. Let the new specifics be experimented with at the places appointed for such work—viz., the research stations, before being used by the orchardist. In these days of increased costs, &c., a grower cannot afford to use any spray material that is not likely to be fully effective.

Time of Application.

The third point, the time of application, is an important one, and should be given every consideration by the grower. It must be remembered that all sprays for fungous diseases are applied in anticipation of attack, and that control depends largely in keeping a protective cover on the developing foliage and fruit until all danger of infection has passed Although exact dates cannot be given for the different spray applications, all spray programmes are arranged in accordance with growth periods such as bud-movement, green-tip, petal-fall, &c. Therefore it is necessary that growers watch the development of their trees and spray accordingly It must be stated that although all scheduled sprays throughout the season are necessary for the protection of clean fruit, the early sprays are the most important, and that time lost at this period cannot be recovered Special reference is made to the " base " or " foundation " sprays, without which no grower can expect to get satisfactory results

It is hardly necessary to dwell much on the fourth point -proper methods —except to state that thoroughness in application of sprays is a necessity. Some orchardists are inclined to rush through the spraying, just to get it finished, and later in the season they wonder why so much disease is prevalent in the orchard An examination of the trees in such orchards after spraying would show that only a portion of each of the trees had been covered, leaving the balance unprotected from diseases. Good nozzles, adequate pressure, constant agitation of the spray, correct measurement of materials and mixing of the sprays, and complete coverage, are most essential.

Spray Schedules.

Slightly different spray programmes are necessary for each different fruit district in the Dominion, depending on the climatic conditions prevailing, consequently it is advisable for growers, when in doubt, to get into touch with the Orchard Instructor for the district, when all necessary information will be supplied.

As it will only be necessary to apply the initial or " foundation " sprays before further notes appear in the *Journal*, only these will be discussed here, deferring the issue of a general programme for the season until next month.

In arranging any spray programme due consideration must be given to the different varieties grown, and their susceptibility to injury or disease. Again both insect pests and fungous diseases must be considered. The three principal and well-tested sprays are winter-oil, lime-sulphur, and Bordeaux mixture. If San Jose scale is present a thorough application of winter-oil at strength 1–20 will be necessary ; this spray will also control mealy-bug, cottony-cushion scale and other scale insects. Lime-sulphur at strength 1–10 will also have a controlling effect on San Jose scale, as well as destroying many red-mite eggs. Bordeaux at a strength of 5–4–50 is undoubtedly the best foundation spray in the majority of varieties for the control of black-spot, and will do much to ensure a clean crop throughout the season. Some growers, when considering the control of both insect and fungous diseases, combine the winter-oil with Bordeaux mixture. This is a saving of labour, &c., but it is preferable to use them separately For the control of black-spot on pears a foundation spray of Bordeaux mixture at strength 5–4–50 should be applied, taking care to cover every part of the tree. Peach leaf-curl, brown-rot, &c., on stone-fruits can also be kept well in check by an application of Bordeaux mixture 5–4–50 when the terminal leaf buds begin to swell.

Cultivation.

In many instances the cultivation of the orchard is not given the attention necessary to enable the fruit-tree to function properly throughout the season. Some growers maintain that, providing a liberal supply of manure is given every season, cultivation does not matter This is an erroneous idea, the proof of which can easily be seen in almost every district The turning-under of the cover-crop should be proceeded with immediately, to enable rotting of the vegetable-matter to take place before the trees start into growth Where no green crops were sown, the ploughing should have been completed before these notes appear, and the work of breaking down the furrows carried out as soon as weather conditions permit. Attention should be given to cultivation around the base of the trees Neglect in this respect not only makes the orchard look unsightly, but creates a harbour for all kinds of pests and disease.

Manuring.

The depletion of the food from the soil by the yearly production of fruit is appreciated by growers, and much more attention is being paid to manuring than formerly. The value of green crops for the supplying of humus and nitrogen cannot be overestimated, but still a regular manurial programme is as essential as a regular spraying programme if success in orcharding is to be attained Only a general outline with regard to manuring can be given, each district having its soil differences, in fact, each orchard presents a different problem. Generally speaking, a combination of the three essential elements —nitrogen, potash, and phosphates — give the best results, although in some instances modification is necessary. Growers should study their trees from year to year, watch results as far as growth, cropping, &c , is concerned, and apply manures to improve the fertility of the soil. If growth is lacking an application of nitrogen should be given, whereas if the fruit is lacking in colour, spurs weak, and crops small, potash should be applied An application of carbonate of lime at the rate of 1 ton per acre every three or four years will do much to correct acidity in the soil, enable the bacteria to function, release plant-food, and improve the physical condition of the soil

—*George Stratford, Orchard Instructor, Motueka.*

Citrus Culture.

Sweet oranges have been grown and sold in New Zealand for many years past, but the quantity produced by any one grower has, in most cases, been small. This condition has resulted in haphazard methods of harvesting and marketing, little study or attention having been given to ascertaining the most suitable dates for harvesting the different varieties. During the last two or three years in particular, this aspect of orange-culture has received greater attention and many observations have been made.

There are various scientific methods of determining when a sweet orange has reached that stage of maturity that it is suitable for dessert use, but it is not intended here to explain these technical methods. The sweetness of the juice and the lack of acidity, as judged by the palate, is the simplest method of determining maturity. When making such tests it is a good practice to have in hand a good-quality imported orange for the purpose of making comparisons. When fully ripened, the principal varieties grown in New Zealand should be equally as sweet as the best imported fruit.

It is estimated that fully 75 per cent. of the sweet oranges grown and marketed in New Zealand are harvested before the most desirable stage of maturity has been reached. This common error of judgment has had the unfortunate result of creating the impression amongst many consumers that the New-Zealand-grown fruit invariably lacks sweetness, which is contrary to fact. Until this impression is removed, New Zealand oranges will not command the degree of popularity that they deserve.

No fixed dates can be set for the commencement of harvesting the different varieties, as both the season and the locality are liable to make considerable differences in this particular. However, under average conditions, there are few, if any, varieties that are fit for harvesting before the middle of July, and fruit that is reasonably fit for marketing at this date would certainly improve in flavour if left on the trees for a further few weeks. Late varieties such as Valencia, St Michael, and Lue Gim Gong should never be harvested before October.

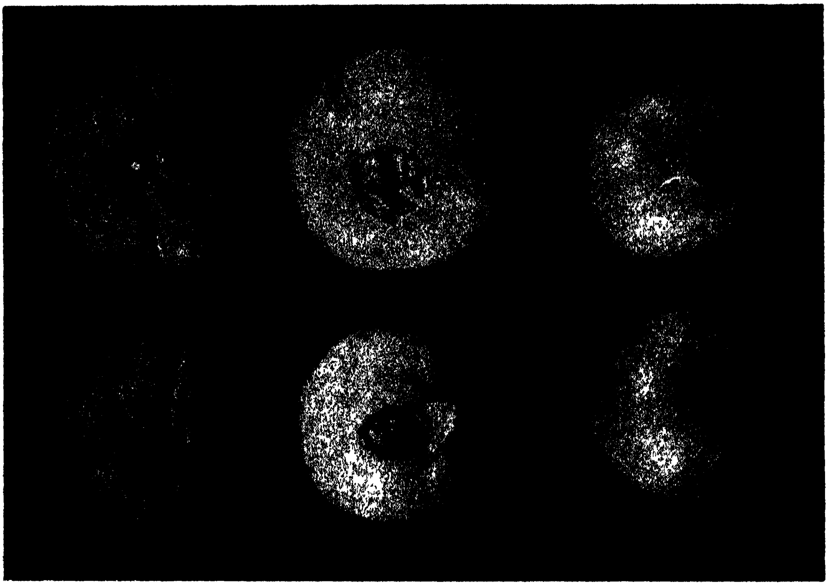
There is a danger with certain varieties, particularly certain strains of the Navel orange, for the fruit to lose its juice if allowed to remain on the tree for any appreciable period after reaching full maturity. There is evidence which indicates that trees grown on the citronelle stock are most likely to become affected in this way. The citronelle stock is also liable to cause the same trouble in Valencia oranges when allowed to remain on the trees until late November, although by no means does this occur in every instance. Young trees that are making vigorous growth are most susceptible to this trouble. Where the danger exists care must be taken to harvest the crop before the loss of juice commences.

New Plantings.

Where the planting of young citrus trees is contemplated, a thorough preparation of the soil is of great importance, and the work entailed is a profitable investment. The importance of providing adequate shelter before the trees are planted out cannot be overstressed. In most circumstances where shelter has not already been provided, the best results will be secured by planting the trees in nursery rows, where they should reman for one or two seasons while the shelter is growing. In most localities where citrus trees do well the present is a suitable time for planting. Where frosts are still to be expected, the trees should be protected ; light brushwood arranged around the trees in pyramid form is a suitable method of guarding against frost damage, and at the same time affords protection from cold wind, without completely shutting out the beneficial rays of the sun. A heavy mortality rate in newly planted trees is not uncommon, especially when a dry period follows the planting. Probably the most common cause of this mortality is allowing the roots to become dry or partially dry before planting. Where this occurs no amount of irrigation after planting will completely counteract the detrimental effect.

Washington Navel Orange.

In view of the increased interest now being taken in the planting of sweet-orange trees, a word of warning appears to be desirable regarding this variety. In many orange-producing countries the Washington Navel is the most popular variety grown commercially, yet in New Zealand by far the greater number of trees of this variety are producing fruit of a very poor quality. The greatest factor in bringing about this unfortunate result is believed to be lack of adequate bud selection, while the use of an unsuitable stock has also probably accentuated the position in many cases. The fact that a few Washington Navel trees in New Zealand are producing heavy crops annually of the best-quality fruit indicates that the fault does not lie in the variety The poor strain of Washington Navel, as shown in the accompanying illustration, usually has a thick rind, the partitions are irregular, and it is deficient in juice. Also, when allowed to remain on the trees for any appreciable period after reaching full maturity, the juice content rapidly diminishes Fruit of the best strain, when the tree is grown on a suitable root-stock, will usually retain its full juice content on the tree until late in October, and sometimes even much later in the season.



WASHINGTON NAVEL TYPES.

Four on left inferior strains, two on right desirable.

—*P. Everett, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

The Eggs.

It is well known to every one that the small yet important and very palatable article of diet, the egg, is very commonly used, but it is doubtful whether many realize the full value of this item of food. Owing no doubt to its high food value and the ease with which it can be prepared, the egg is one of the most commonly used articles of food of animal origin. No other animal food can be used in so many varied ways, and got ready for use in so short a time.

The egg contains those food principles that best nourish the body, and we are told by those qualified to speak on such matters that the chemical composition of the egg and of the human body are nearly the same, and that ten eggs are equal in food value to 1 lb. of beef, but that one dozen eggs would better serve a family of five or six. The egg is used in many different forms not only for adults, but for the child, the youth, the strong, and the invalid.

In addition to its food value, the egg is at times of value for other purposes. For instance, the white of the egg is a known remedy for burns. Egg-shells, on account of the purity of carbonate of lime contained therein, are sometimes used for the making of medicine. In his interesting survey of the poultry industry, Mr. E. J. Fawcett, Technical Liaison Officer of the Department of Agriculture, estimates that the approximate consumption of eggs in New Zealand is just on 300 per person per year, which means that the people of this Dominion, with its population of 1,578,757, consume approximately 39,469,758 dozen eggs each year. It has been estimated that England produces more than half the eggs consumed by its population, yet the latest statistics show that it costs that country some £16,000,000 sterling per annum for imported eggs.

Care needed.

The lack of appreciation of the perishable nature of the egg is causing a heavy annual loss in this country. The poultry business is one that depends to a great extent on the constant attention to detail in order to ensure success, and it is doubtful whether any branch of primary industry calls for more particular attention than the care and preparation of the egg for market. In fact, there is a great correlation between the successful poultry-keeper and the way he sends his eggs to market.

Desirable Qualities.

Freshness, cleanliness, and flavour are the most desirable qualities in a good marketable egg, and there are few other products where value depends more directly on flavour and freshness than the egg.

When a fertile egg is exposed to a certain temperature, whether it be under a hen, in a hot kitchen, a warm store-room, or elsewhere, the embryo starts to develop, with the result that its flavour is soon spoiled.

It has been proved beyond doubt that the male bird has no influence on the number of eggs a hen will lay. The infertile egg will keep much better, therefore, unless the eggs are required for incubation purposes, there is no advantage in keeping males running with the flock.

The egg will very quickly take up or absorb objectional odours or mustiness, and for this reason care should be taken when eggs are being held for market to see that they are kept away from such materials as kerosene, paint, onions, fruit, &c.

Mustiness.

Mustiness is one of the worst defects in an egg that a baker has to contend with, owing to the fact that it is almost impossible to detect the mustiness except by tasting it.

As the chief causes of mustiness are due to the egg being laid in damp straw, damp or soiled nests, or being forwarded to market in damp, soiled fillers, every care should be taken to see that plenty of dry, clean nests and nesting material is supplied, and that the eggs are collected at least once a day and sent to market in clean, dry fillers or containers. Experiments have proved that an egg kept in a temperature between 50° and 60° F. will be fresher at the end of three weeks than when kept in a temperature of 70° F. for a week, and for that reason the egg should always be stored in a dry, cool place.

The Local Market.

The building-up of the poultry industry and placing it on a higher plane will depend, very largely, on the poultry-keeper, how he sends his eggs to market, and how he caters for his very best customer—namely, the local consumer.

Several years of supervising the grading of eggs for export has shown, as a rule, that the large producer who depends chiefly upon the sale of the commercial egg does send his produce to market regularly and in an attractive condition, but, unfortunately, a number of the more-or-less small producers, or, may it be said, the uninterested poultry-keepers, fail to give that little extra care and attention to the egg before sending it to market, and which has such an influence on the sale.

On one occasion while supervising the grading for export a consignment of 1,500 dozen eggs arrived at the export floor from country stores. After examining the contents of nine cases (225 dozen) it was found that owing to the soiled condition of many of the eggs only 20 dozen could be found suitable for export. The result was that the whole consignment had to be rejected and sold at a much reduced price, owing to the fact that it would not pay to grade such a line. Since then country store eggs have not been in demand for export purposes.

It was a pity to see such a consignment of good food, and one so uniform in quality when produced, sent to market in such a state, especially when the country egg, produced by birds kept under natural conditions, is of the very best quality when laid. Many small producers seem to think that because their output is small the few eggs that they send to market do not really count. This is a mistaken idea, for when it is remembered that the last census returns showed that of the 165,949 householders keeping poultry in this country, 134,140, or over 80 per cent. of the total, were keeping under twenty-five birds, and as a very large number of these householders sell eggs during the flush season, it will be realized that their collective output and the manner in which they are sent to market has a very big influence on the local price, also in creating the summer surplus.

Export-trade.

During last egg export season some 338,430 dozen eggs were exported from New Zealand to the London market. This represents a very small percentage of the annual local consumption. Although the prospects of building up a big profitable egg-export trade are by no means bright, the economic importance of sending our small summer surplus overseas cannot be overestimated, for it is that surplus that often has the effect of bringing the local price down below the cost of production.

The export season is just at hand, and as this is a matter that concerns all producers it behoves all, both large and small poultry-keepers, who sell eggs to see that all eggs are sent to market in a fresh, clean, and attractive condition.

Some may think that the estimated consumption in this country of 300 eggs per person per annum is high, but the following may be of interest. The estimated consumption of eggs in Canada during 1920 was 202 per person. During 1921 the Canadian Government, at the request of those interested in the egg trade and with the hope of encouraging a greater consumption, introduced regulations whereby eggs before being placed on the local market had to undergo inspection. The result was that in five years' time the consumption of eggs in that country had gone up from 202 to 337 per head of the population, and now is over 400.

There are good grounds for assuming that if all eggs were sent to market in a clean and attractive condition, and they were a guaranteed fresh article when they reached the consumer, the consumption in this country would be much increased, with a consequent financial benefit to the producer.

Eggs by Air-mail.

In order to test out the above method of transport, this Department arranged with the High Commissioner for New Zealand in London, and on 23rd May a box containing fifteen White Leghorn eggs from England was sent forward from Southampton Airport. The eggs arrived in Wellington on the 15th June, and were taken to this Department's Poultry Station at Wallaceville. Eight of the eggs were placed under a hen, and the remainder in an incubator. At the end of fourteen days there were sure indications that none of the eggs would hatch.

The experiment, although interesting, would indicate that it is not possible at present to get results from hatching eggs when sent so far by air-mail.

C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Breeding.

Colonies in normal condition should now have a good quantity of sealed brood in the combs, with young bees emerging every day. The queens will be laying well, though not up to their full capacity, but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will be acting as field-bees, and the older autumn-bred ones will be dying off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for the feeding of the brood. All through the spring, when weather conditions are favourable, some nectar can be gathered, and often a good deal is stored, which helps to supplement the stores in the hive. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last several days the food-supply will diminish rapidly, and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

Hints to Beginners.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted. Cracks and knot-holes may be of use for ventilation in the summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts. Moreover, any holes except the entrance offer an inducement for robbers to investigate, and necessitate the bees employing extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood ; but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feed only in the evening, inside the hives, and use a syrup in the proportion of two parts water to one part sugar ; dissolve thoroughly and feed as soon as it has cooled sufficiently to be harmless to the bees.

Provide permanent shelter. A live hedge is the best, if kept trimmed to a height of 8 ft. or 10 ft. Failing this, some kind of breakwind is essential.

The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent

Open the hives only on warm, still days. Make necessary observations as quickly as possible, and take a note of them at once. The inside of the cover makes a good rough diary, and does not get lost or mislaid ; mark the date of each examination. Endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen , she is easily distinguished by the length of her body and the comparative shortness of her wings. Try to make a rough estimate of the weight of each frame as you lift it, comparing it in your mind with that of an empty comb, thereby arriving at some idea of the quantity of stores in each hive. Do not try to run many hives until the rudiments of the business have been grasped, but be content with one or two strong colonies until the learner's stage has been passed.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

WITH most of the early crops under way consideration is now given, during the month of September, to the planting and sowing of main crops, such as potatoes, turnips, salsify, carrots, peas, leeks, lettuce, spinach, and also salads , towards the end of the month sowing Brussels sprouts, savoy, cauliflowers, and celery for December planting. These operations, together with the preparation of the land so soon as it is available for planting out half-hardy crops towards the end of October or beginning of November, makes this season a busy time in the garden when the interruptions of stormy intervals are taken into consideration. Where the land is heavy or the drainage indifferent so that drying is slow the management often has a trying time

In the June number of this *Journal* the names and addresses of seed-potato growers receiving provisional certificates for the crop were published The acreage of seed of each kind indicates the outstanding popularity of the main-crop varieties Ancklander Short Top and Dakota, the former being an easy favourite. The Aucklander Short Top is a selection from Sutton's Supreme made by a grower in Kaiapoi and introduced into commerce in 1910. A further selection of the same origin made a few years later is known as Aucklander Tall Top. It is one the heaviest croppers, but later in ripening , and, although the tubers are somewhat similar, they have not the quality of the Short Top. Dakota was produced in America some years ago. Its red, oval shape and good keeping and cooking qualities are well known. Other main-crop varieties well represented among the certificated seed crops are Arran Chief, King Edward, Inverness Favourite, and Arran Banner. Light cultivation is given during fine weather, after planting potatoes and before germination has taken place, so soon as a crop of seedling weeds makes its appearance or a crust forms on the surface of the land. The crop may be harrowed lengthwise with the rows without injury until the plants are well above the ground. This attention will save a great amount of hand-work. After the plants are well above the ground the first cultivation given is deep and carried close up to the plants. Later it is shallower and farther away with a view to avoiding injury to the roots.

A culinary turnip of excellent flavour, keeping quality, and early maturing is Purple Top or Early Milan. In districts where the season is too short for sowing an autumn crop of carrots a main crop of a good intermediate variety is usually sown towards the end of the month of September—they are then in better condition for use in winter than if sown earlier. Fresh green peas in the spring are something of a luxury, as they may only be grown on limited areas in select localities; an early crop in bigger supply is available about the month of December and is very popular. Later the supply often falls off rather quickly, and this can be avoided by sowing at intervals up to the month of December inclusive. For planting out in January on land from which an early crop has been taken a sowing of leeks should be made now. The crop is hardy and little troubled with pests, it is a winter crop of the greatest utility, and is most useful and agreeable if grown to a moderate size only. New Zealand spinach is found growing wild on our light coastal lands. For use in summer when a supply of good, clean, green vegetables is often scarce it should be more often planted in the garden. It is not easily packed for the market, but for home use it is quite suitable and will satisfy the most critical tastes. To obtain early plants it is sown now in boxes in a frame for planting out towards the end of October, but otherwise it requires little attention if given a warm position. Silver beet is another vegetable of this class which may be sown now where summer cabbage of satisfactory quality is difficult to grow.

Plants of the cabbage family will now be subject to the attack of white butterfly larvæ and other pests, but satisfactory protection is afforded by dusting the plants lightly with derris, an extract from the roots of a tropical plant. It may be obtained from any seedsman, and is best obtained fresh, as it is inclined to depreciate if carried over into a second season. This material is non-poisonous and is preferable to arsenate of lead as a remedy for these pests when attacking plants of the cabbage family.

In growing celery it is to be remembered that one is dealing with a marsh plant—that is a plant requiring an abundance of humus and water. The land, however, must be well drained so that the water is not in the least stagnant. For commercial cropping the land should be naturally light, rich, and moist, or there should be good facilities for irrigation. Where the land is inclined to sometimes dry out the crop is planted in trenches. The September sowing may be made outside on suitable land. Broadcast a light dressing of superphosphate and maintain a clean fallow sufficiently long to destroy weed seeds, and then sow in drills a few inches apart. Mulch lightly with well-decayed manure and water well with a fine spray. When the plants are about 3 in. high they should be " wrenched " by cutting the tap root a few inches beneath the surface of the ground, using a bright sharp spade or similar implement. This is best done in dull weather when rain is threatening.

Small and Sundry Fruits.

Established brakes of hardwood plants of this class will require light cultivation to suppress weed-growth and work in any artificial fertilizers that may be necessary to supplement the winter dressing. It is important the cultivation should be light, as any disturbance of the roots at this season will seriously interfere with growth and cropping. As regards fertilizers, the potash requirement should not be overlooked, especially for gooseberries, red currants, and raspberries; it improves the quality of both the wood and the fruit. Where plantations are approaching the end of the term of their useful life plans should be made for new plantings to be made on fresh land next season where a similar crop has not been grown during the past three years. Planting of this class to be done during the present season should be completed without delay, giving careful attention to pruning. Young raspberry canes, planted this season, should now be cut back to a length of about 8 in. to encourage strong sucker-growth.

Culinary and dessert fruits usually planted out during the month of October include tomatoes, passion-fruit, tree-tomatoes, Cape-gooseberries, melons, cucumbers, and—during the month of November—peppers and egg-plants. Most crops of this class require a light, rich soil in a warm, sheltered position. In many instances the land to be planted is at present occupied with a winter or spring crop such as cabbage, but the preparation of the land should be commenced promptly so soon as the present crop is cleared so that it may have time to settle and cleaning may be done. In deciding on a formula for manuring the present condition of the land must be taken into consideration. For instance, where a generous dressing of organic manure has been applied for the previous crops and a tomato crop is to follow, phosphates and potash will be the main requirements, while if the supply of nitrogen in the land is inclined to be high the amount of potash applied may be increased proportionately. Most of the plants mentioned will have been raised under glass and require to be gradually accustomed to outside temperatures and other conditions before planting out. This operation, known as "hardening off," must be done with consideration to avoid a serious check in the growth of the plants. It generally takes about a fortnight, during which time the plants are placed in a frame with a well-sloped canvas cover which can be used during hard weather. It is done most successfully when the plants have been grown steadily from the commencement and given air at every reasonable opportunity.

The Homestead Garden.

In most districts the present time is the peak of the planting season for both hard-wooded plants—trees and shrubs and for softwoods—and hardy herbaceous perennials For most kinds planting is best done now when the land is sufficiently dry In readiness to take advantage of such opportunities the plants should be obtained and heeled-in in friable soil in a convenient position. Most kinds of hard-wooded plants should have the branches thinned out and shortened well back to "outside" buds after planting This is done with the greatest consideration with a view to obtaining a well spaced, strong framework, of the desired design, quickly. When setting out young trees especially, planters often lack the courage to prune sufficiently hard Exceptions in the treatment of young plants of this kind are climbing hybrid trees and perpetuals, and varieties of the class Pernetiana These are thinned out moderately and shortened back lightly.

Among the hardy herbaceous perennial plants set out now consideration should be given to violet varieties and species of helleborus which have provided a welcome display of blossom during the winter months Both require a rich, moist soil that does not dry out in summer. The hellebore species are chiefly natives of Balkan countries and thrive best in shaded positions. The month of September is a suitable time for repotting most kinds of house plants that may require it It is important to make the soil rich and light by mixing with good, fresh loam a generous amount of humus in the shape of leaf-mould or thoroughly decayed manure and sharp sand; this is best done at least some days before it is used.

Where new lawns are to be made by seeding or turfing the work should be completed as soon as weather permits. It is most urgent in localities where a dry summer season is sometimes experienced. As stated before, the surface should not only be smooth, but it should be of correct height and graded in such a way as to dispose of surface water in a satisfactory manner. Adjustments of this kind must not be hurried, but completed satisfactorily before laying turf—or sowing seed—during a period when there is no wind.

The high condition of sports greens, subject to frequent rough usage, is only maintained by constant attention and feeding. Although it is not always realized it is a fact that a good lawn is one of the most important features in the garden. A close, fine turf is very attractive and makes the best setting for buildings, trees, and shrubs in the vicinity. Fenced off from grazing stock and closely cut, the plants making up the turf are soon short of nourishment, and weeds find an easy footing. The desirable turf condition is only maintained by supplying suitable manures and fertilizers. A lawn on light land requires liberal dressings of organic manures during autumn or spring—sometimes at both seasons. These should be in a finely divided state to facilitate even distribution. Most lawns, however, are greatly improved by dressings of sulphate of ammonia and sulphate of iron during the spring-time and superphosphate in early autumn. The spring-time dressing should now be given after the larger perennial weeds, such as rib-grass and cats-ear, have been removed. It may be composed of three parts sulphate of ammonia and one part of finely ground sulphate of iron by weight and applied on two or three occasions at monthly intervals at the rate of 1 oz. to the square yard. It is most convenient to mix the fertilizers with about five parts of fine, dry sand or old potting soil.

Wm. C. Hyde, Horticulturist, Wellington.

ANSWER TO INQUIRY.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GROWING OF LUCERNE.

E. A. M. L., Dannevirke :—

In November, 1936, I sowed some lucerne, using 8 lb. of seed per acre. A neighbour of mine had used this amount with success, but I found it insufficient. The lucerne plants that did spring up had rather a bad time with the sorrel, and later with Californian thistle and grass. I ploughed the area, which was in grass, to a depth of 8 in. in early July, worked it up very thoroughly, and in October put on a ton of lime (carbonate) per acre. A fortnight later I added 5 cwt. of superphosphate per acre, and worked it into the ground, and again a fortnight later, early November, I drilled in the lucerne-seed (7 in. drills) after having mixed it with culture supplied by the Department of Agriculture. At the time of sowing I used 2 cwt. of blood and bone manure per acre.

I have fenced the area, which required over 500 yards of fencing, and have planted Lawsonianas all round the paddock, so I am most anxious, having gone to this expense, to have a stand of lucerne. The soil is naturally well drained and should be ideal for growing lucerne. I am afraid the Californian thistle will become worse with further cultivation. Will you please advise me as to the best course to take now, giving me full details.

Fields Division :—

The general preparation and manuring appears to be satisfactory ; the mention of sorrel and grass, however, would indicate a seed-bed tending to be loose and open, and the use of a roller on the plough furrow before disking and again on the seed-bed before sowing would assist in getting a good take of lucerne, which likes a clean and firm seed-bed. 8 lb. of seed per acre is generally considered too light a sowing. From 16 lb. to 20 lb. is the general practice to ensure a sufficiently dense cover of young lucerne to compete with weeds. Owing to the liability of damage to the culture, it is not advisable to use a nitrogenous manure such as nitrate of soda or sulphate of ammonia, or an organic fertilizer such as blood and bone, with the seed. Blood and bone is also liable to affect germination under some conditions. The improvement of a poor stand, particularly under the conditions indicated in your letter, is a difficult problem, and one best discussed on the area. Surface-sowing of more seed after cultivation is generally unsatisfactory, as the young seedlings are smothered by the older lucerne-plants, and by weeds, which it is often impossible to eradicate.

WEATHER RECORDS: JULY, 1937.

Dominion Meteorological Office.

NOTES FOR JULY.

THE cold weather, with a prevalence of southerly winds which had characterized June, persisted through the first eight days of July, but thereafter weather of a more westerly type prevailed and conditions were definitely milder. Towards the end of the month some beautiful days were experienced in most places. Rainfall was generally much below and sunshine above average, but nevertheless the weather during the month was rather unsettled and, except in eastern districts, more especially in the South Island, rain, though often light, was rather frequent. Over western and central districts of the North Island the soil was continually damp and muddy, and conditions on the farms were unpleasant. There was little growth of vegetation. In Canterbury and Marlborough, on the other hand, it was possible for some arrears in agricultural operations to be made up in numbers of places. The area under crop is, however, likely to be considerably less than during last year. Stock, except hoggets, are reported as doing well, but a spell of dry and sunny weather would be welcome. Early lambs have appeared in numbers of districts, and so far the losses have been light.

Rainfall.—Except in comparatively small and isolated areas the rainfall was much below normal In Marlborough and Canterbury the totals were particularly low.

Temperatures. Temperatures were almost everywhere below normal, though the departures nowhere amounted to 2° F.

Sunshine —Though below it at a few places, more especially on the west coast, sunshine was generally considerably above average

Storm Systems.—On the 1st a cyclonic depression was centred over North Auckland Easterly gales blew in the far north and south-easterlies in Taranaki. There were some heavy rains in northern districts By the 3rd the depression had moved away and an anticyclone had enveloped the Dominion. The centre was, however, far to the south, and cold southerly winds persisted.

On the 5th a depression, with a considerable extension in the south-to-north direction, advanced from the Tasman Sea and crossed the country during the night. On the 6th strong south-westerly winds were blowing. This storm caused general rains. Snow was widespread in the South Island and reached low levels on the mountains in the North Some very severe frosts followed.

From the 9th to the 17th there was another unsettled spell. This began with a series of westerly depressions, but from the 14th an intense anticyclone covered Australia and extended over the Tasman Sea, while several depressions followed each other on a southerly course off the east coast of New Zealand. Southerly gales blew on the 16th to 17th. Snow again fell to low levels on the ranges, while there was hail and thunder in many places.

The improvement which followed was only brief, and between the 19th and the 22nd another series of depressions passed. Some heavy rains fell in western districts. There was considerable thunder and hail on the 22nd, and two men were struck by lightning near Otorohanga.

An anticyclone covered the Dominion on the 23rd and 24th, but westerly depressions were soon again following each other across the South Island. There was heavy snow on some of the ranges on the 27th, and hail and thunder were reported for the third time during the month. The last three days saw a considerable improvement.

RAINFALLS FOR JULY, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Fall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	..	..	..	5·48	..	33·64
Russell	4·56	13	2·37	6·72	68·28	37·34
Whangarei	5·62	23	1·18	7·19	57·37	38·79
Auckland	4·23	25	1·21	5·58	30·22	29·86
Hamilton	..	..	..	5·10	..	29·00
Rotorua	2·44	14	0·86	5·00	30·88	31·85
Kawhia	..	..	..	6·01	..	31·55
New Plymouth	6·51	23	1·18	6·38	38·59	34·92
Riversdale, Inglewood	8·96	20	1·82	10·06	60·55	58·71
Whangamomona	..	..	..	7·27	..	42·97
Hawera	3·88	17	0·71	4·22	26·62	25·61
Tairua	6·77	17	1·53	6·31	37·48	39·87
Tauranga	3·57	17	1·34	4·94	33·68	31·82
Maraehako Station, Opotiki	8·38	13	2·53	4·45	40·02	32·24
Gisborne	3·66	15	0·79	5·05	22·74	29·96
Taupo	2·29	12	0·84	3·87	20·60	25·23
Napier	3·27	11	1·45	3·27	14·84	19·35
Hastings	2·03	10	1·15	3·66	11·44	20·29
Taihape	2·36	19	0·50	2·97	20·02	20·78
Masterton	4·28	17	1·30	4·18	21·06	22·95
Patea	2·83	19	0·66	4·23	27·16	25·63
Wanganui	1·22	11	0·25	3·34	20·31	21·04
Foxton	0·78	7	0·30	3·11	13·90	18·38
Wellington	3·93	16	0·81	4·85	22·59	25·74
South Island						
Westport	8·46	17	1·86	8·30	50·64	54·80
Greymouth	8·23	21	2·05	7·93	64·33	57·49
Hokitika	7·28	20	1·82	8·96	66·90	64·05
Ross	5·65	14	1·35	9·18	77·29	71·95
Arthurs Pass	..	..	..	9·93	..	85·87
Okuru, South Westland	12·69	9	2·20	10·52	91·30	82·56
Collingwood	6·35	10	2·40	9·40	53·82	54·96
Nelson	3·40	8	1·12	3·48	22·01	21·80
Spring Creek, Blenheim	1·18	8	0·42	3·42	15·95	17·89
Seddon	0·72	7	0·31	2·40	14·02	14·72
Hanmer Springs	2·57	10	0·61	4·29	20·32	26·06
Highfield, Waiau	1·18	6	0·33	3·34	13·47	30·08
Gore Bay	1·34	9	0·31	2·80	20·26	18·67
Christchurch	1·91	8	0·93	2·54	14·71	15·17
Timaru	0·37	6	0·15	1·84	13·60	12·98
Lambrook Station, Fairlie	0·69	7	0·33	2·62	12·30	14·60
Benmore Station, Clearburn	..	..	..	1·74	..	14·54
Oamaru	0·56	6	0·29	1·72	10·49	12·70
Queenstown	1·39	12	0·67	2·03	18·67	17·38
Clyde	0·24	3	0·12	0·90	10·37	8·66
Dunedin	1·59	13	0·31	2·98	28·16	21·06
Wendon	1·64	11	0·32	1·74	29·34	17·22
Balclutha	1·46	11	0·49	1·78	23·18	14·49
Invercargill	3·48	19	0·60	3·27	28·31	26·58
Puysegur Point	7·93	24	1·07	6·15	56·23	48·41
Half-moon Bay	..	..	..	4·40	..	33·53

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MANCHURIAN RICE GRASS (*ZIZANIA LATIFOLIA*).

ITS OCCURRENCE AND DISTRIBUTION IN THE NORTHERN WAIROA DISTRICT.

E. H ARNOLD, Instructor in Agriculture, Dargaville.

WHEN numerous ships were engaged in transporting from North Auckland the large quantities of both white-pine and kauri timber, many arrived in ballast, which usually consisted of soil loaded at the last port where cargo was discharged. On arrival in the Northern Wairoa, the ballast was indiscriminately dumped along the banks of the river. From such ballast dumps, deposited from a ship which, according to early settlers, arrived from South Africa some thirty or forty years ago there spread and naturalized itself along the river-banks an exotic plant. This plant is called locally jungle grass, South African grass, reed-grass, rice-grass, or elephant grass. Recently, owing to its spread along the soft mud of the tidal-river banks, following up and blocking watercourses and drains, gradually working its way into damp or swampy places, and slowly encroaching on flat pasture land bordering the Northern Wairoa River, it has caused concern among the farmers whose land is adjacent to the river-banks. This plant has been identified by Allan(1) as Manchurian wild rice (*Zizania latifolia*), and is a native of Asia. He further states that in China the thickened bases of the stems are sold as a vegetable, and are said to have a fine flavour.

Manchurian wild rice is a very tall-growing grass, with the stems and leaves reaching a height of from 6 ft. to 10 ft. It possesses a strong deep rooting-system and far-reaching rhizomes. In the soft river-banks the thick roots penetrate several feet into the soil. It also has the undesirable habit of sending roots and rhizomes down under drains and trenches which have been dug to prevent its spread, and throws up suckers or new plants on the other side of the trench. In some places it is found growing on the roadway, the suckers having broken through 10 in. to 12 in. of road-formation. During the winter little or no growth occurs. The old leaves, particularly where exposed to severe winds, begin to die off, but the remainder of the plant remains fresh and green. About September fresh green growth is produced throughout the area of the grass, and, if soil conditions are wet enough, new shoots from rhizomes are given off for a distance of usually up to 3 ft. on the land side of the affected area. However, the extent of

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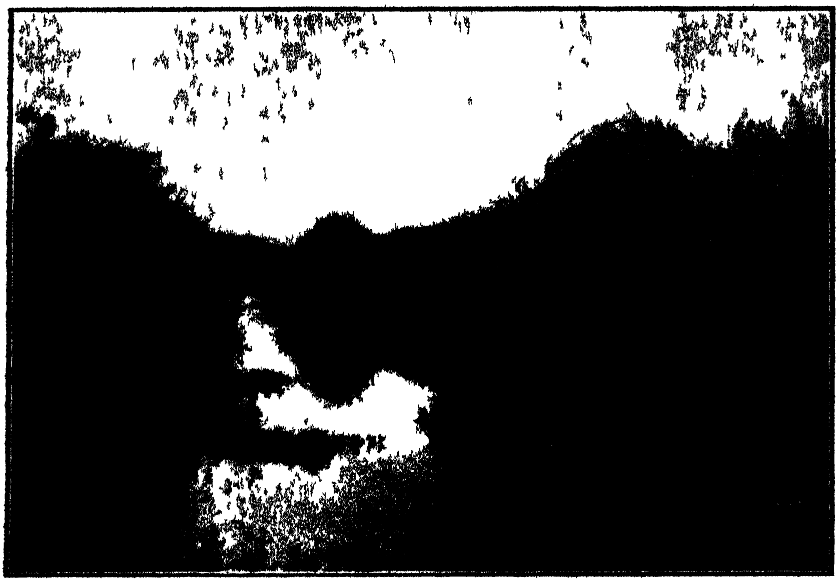

FIG 1 MANCHURIAN WILD-RICE GRASS (ZIZANIA LATIFOLIA) GROWING ON BOTH SIDES OF A DRAIN AT ARATAPU

In some cases the grass will form a complete belt on each side and eventually block the drain

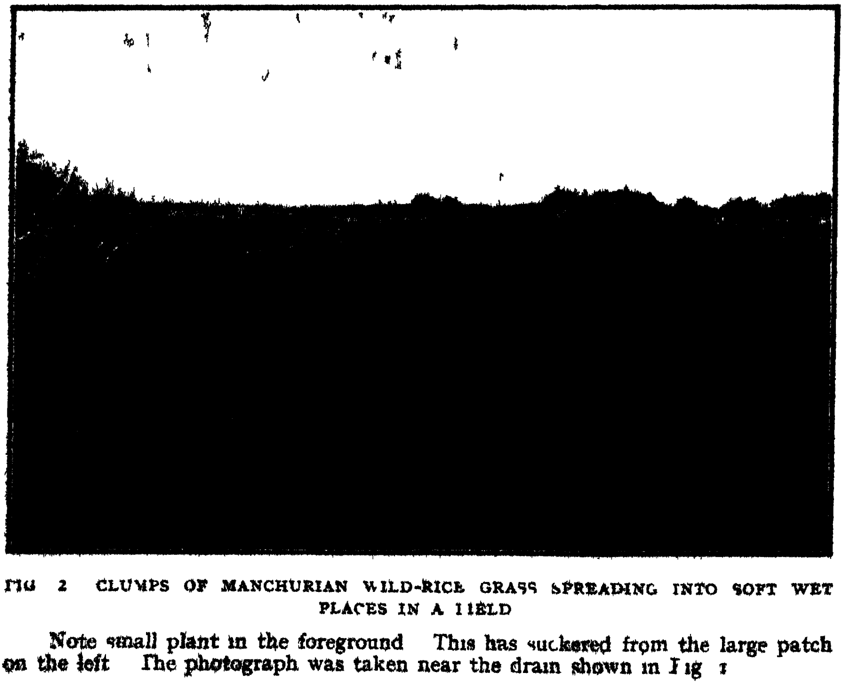

FIG 2 CLUMPS OF MANCHURIAN WILD-RICE GRASS SPREADING INTO SOFT WET PLACES IN A FIELD

Note small plant in the foreground This has suckered from the large patch on the left The photograph was taken near the drain shown in Fig 1 spread along the softer river-bank is considerably greater. During late November or early December, flowering-stalks, which carry in a panicle the female flowers above and male flowers below, are sent up within 8 ft. to 10 ft. of the outside wall of the grass. The plant is an irregular seeder, but in some seasons quite a fair amount of seed has been produced. When ripe the seed falls and is carried both up and down the river by the regular rise and fall of the tide. If floods occur, the seed may be deposited on pasture land, where it quickly germinates, and new centres of growth are established. From single plants derived from seed or portions broken away from established plants, the grass spreads to other areas along the river previously free of Manchurian rice-grass. At Hoanga there is a patch of approximately 1½ square chains, which has during the last fifteen years, despite several cuttings and burnings-off, spread from a single plant. On the opposite side of the river at Awakino Point rice-grass has encroached over a stop-bank, under and across a drain and out into a field, apart from the stop-bank and drain, a distance of 21 ft. in the past four or five years. In general, however, the spread inland may not exceed 2 ft. or 3 ft. each year. By such methods, from the various centres of establishment, the patches grow into continuous belts, which in some cases are up to 2 chains in width along the river and creek banks.

The Manchurian rice-grass extends over a distance of some twenty-five miles along the banks of the Northern Wairoa River. Small areas occur up the Naumai Creek, and from there, up the Northern Wairoa River, intermittent patches are present on both banks to within a few miles past Tokatoka. From there, particularly on the western bank, more or less continuous belts up to 2 chains in width occur. It has penetrated varying distances up side creeks and drains. It exists over approximately one mile along the banks of the Aratapu Stream, and belts of differing sizes are to be found for a distance of four and a half miles up the Kaihu River. The widest belts are found about half a mile above the bridge at Dargaville, round Awakino Point, and on the opposite banks at Hoanga. From there up the river it grows in belts and areas of varying sizes to within a short distance of Pukehuia.

Several factors appear to influence the rate of spread of Manchurian wild-rice grass. As the tidal effect becomes less in the river, the grass is stronger-growing, encroaches more rapidly on to good land, and causes more trouble through affecting stop-banks and blocking entrances to drains. Shade trees inhibit the growth and spread. On one farm, where such trees (pines) were planted some twenty or thirty years ago, there occurs a break in what is otherwise a continuous belt of rice-grass. Further, in some places, belts of New Zealand flax growing between the stop-banks and the water tend to hinder its spread into good grass paddocks. On farms where English grasses are in combination with paspalum, and where ample winter feed is provided by means of hay and silage, and also on partly drained farms with much roughage where stocking is not heavy, this grass is left alone by stock. However, on farms where winter feed is short or lacking stock will eat a small proportion of the shorter outside growth, and thus maintain some check on its spread. Here the grazing animals not only eat back the younger growth and tips of the longer, coarser, unpalatable leaves, but also make tracks through the grass areas and derive a considerable amount of shelter during the winter and early spring months when cold westerly or south-westerly winds are common. Otherwise stock do not have a liking for the grass. It also appears that Manchurian rice-grass will not stand tramping by stock to any great extent. This would be effective only on the drier land, and not on the river side of stop-banks or on undrained areas.

As mentioned before, the slow insidious encroachment of rice-grass on to the good land is causing considerable concern and attention among farmers. Some do not give it much thought, and have a good word for it. These men are inclined to value it as a shelter for stock during the winter and early spring, and also claim that it assists to hold the stop-banks together. However, during an investigation, in some instances, it was found that where the grass grows densely along stop-banks, the formation, instead of remaining firm, has now become a mass of soft mud which does not dry out and then slowly flattens out to be washed away by the tidal current. Where it only possesses a strip of the river-bank, and conditions do not allow of its spread inland, it is no doubt valued as a winter feed for dry stock, especially bulls and yearlings. Here little or no winter supplementary feed is available, and its value arises through poor farming methods. Where the grass does cause trouble, interfering with the efficient working of drainage systems and encroaching into pastures, may methods of control and eradication have been attempted. Burning during dry spells was no doubt the method which most readily recommended itself. Even if what might be called a good "burn" occurred there was always 2 ft.

FIG. 3. A BELT OF MANCHURIAN WILD-RICE GRASS ENCROACHING INTO A FIELD AT AWAKINO POINT.

The grass has spread from the river-bank on to the stop-bank over a drain and through the fence out into the pasture.

or 3 ft. of the more open and shorter growth left unburnt round the outside. The face of the area was left free to extend, while fresh vigorous growth soon commenced over the burnt area. Use of the flame-thrower has been made. The first burning requires considerable treatment, and, as in the case of ordinary burning, the regrowth is very rapid. Further treatments of the regrowth will probably be necessary, thus making a control which is of questionable value, expensive, and not likely to be really effective for general adoption. Cutting, particularly in the soft mud is difficult and costly. Further, it appears to only prune the plants, which recommence growth with renewed vigour. Some farmers who cut small areas utilize the bundles of leaves for laying in roadways which become muddy through continual traffic of stock. This assists for a short time, but produces odours which are objectionable, especially if the filling is near a milking-shed. In other cases the long leaves are cut and used for the thatching of haystacks. The leaves being long and bulky are much more easily and quickly built on to a stack than are ordinary rushes. The rain-water is readily shed and the thatch lasts until the stack is utilized.

Taking into account the nature and spread of Manchurian rice-grass, as well as the fact that the more common methods of control have failed, the position really becomes most difficult. Eradication does not appear to be possible. Control of the present areas, together with the prevention of its further spread, must therefore be the consideration. The suggestion which offers itself is to make some attempt to confine the grass to those areas upon which it is growing at present. This would necessitate the planting of suitable evergreen shade trees, 5 ft. or 6 ft. inside of the present line of the grass. Trees tolerant of wet conditions would have to be selected. Fencing would be necessary. This, together with the land abandoned as useless, and the area occupied by the shade trees, would make the control expensive. If flood-water causes fresh centres of the grass to be established inside the line of trees, these new plants should then be immediately treated by spading, or by cutting and maintaining the growth constantly at a stage to be eaten by stock. Except for small areas, such as the outlets of drains, chemical methods of treatment are to be considered a waste of time.

(1) ALLAN, H. H.: An Introduction to the Grasses of New Zealand. Bulletin No. 49, Dept. of Scientific and Industrial Research.

The necessity of sowing fertilizer with turnips is well illustrated in the four turnip-manuring trials in the Christchurch district. In each trial one or two drill strips were sown without manure, and these plots are less than one-third as well grown as plots which received super and lime (4 cwt. per acre), reverted super (249 lb. per acre), super and blood and bone (2 cwt. per acre), or proprietary manure (2 cwt. per acre). —*Fields Division.*

In a paddock of rape in Eastern Southland part of the crop was sown broadcast and part of it was sown in ridges. The crop on the broadcast section is poor and stunted, while that on the ridged section is good and vigorous. The quantity of fertilizer applied was the same on both blocks, but the scuffling and inter-cultivation on the ridged rape has made the comparative differences.

—*Fields Division.*

THE AVOCADO.

CULTURE IN NEW ZEALAND.

P. EVERETT, Orchard Instructor, Gisborne.

THE avocado is a tropical or semitropical fruit that was little known in temperate zones until a quarter of a century ago. Since that time rapid progress has been made in the cultivation of this fruit in temperate climates. The name "avocado" is now applied to this fruit in all English-speaking countries, while in certain foreign countries the fruit is known as the "alligator pear."

INTRODUCTION TO NEW ZEALAND.

So far as can be ascertained, the first avocado-trees of known varieties to become established in New Zealand were imported by the Department of Agriculture in the year 1919, and were planted in what was then the Government Horticultural Station at Tauranga, which is located in latitude 38° S. In later years numerous trees were raised from seeds which were imported, and a few of these trees are now bearing fruit. Many other trees have been raised from the seeds of one of the trees at Tauranga, which commenced to bear fruit at an early age. In addition to the foregoing, trees comprising thirteen different named varieties were imported and established at Wanganui.

DESCRIPTION.

The avocado belongs to the genus *Persea,* a member of the Laurel family, to which belong also such economic plants as camphor and cinnamon. The cultivated species of the genus are native of Mexico and Central and South America. They are divided into two distinct species,* *P. americana* and *P. drymifolia;* the former includes all varieties horticulturally grouped in the West Indian and Guatemalan races, and is commonly known as the Guatemalan species. *P. drymifolia,* known as the Mexican species, includes the small-fruited varieties of the Mexican highlands. Both species are represented in the cultivated varieties. The Mexican species can be distinguished from the Guatemalan by the very pronounced anise odour that can be detected in the leaves and young growth of the former when crushed; this odour is entirely lacking in the Guatemalan species.

The tree is evergreen and has a spreading habit, the height usually approximating the spread. The largest tree in New Zealand is reported to have attained a height of 35 ft. Seedling trees are inclined to be more upright than when budded. The leaves may be oval, elliptic, or lanceolate; their base is usually acute or truncate; the apex varies from blunt or acuminate; the length is reported (Hodgson) to vary from 3 in. to 15 in., but, as observed in New Zealand, is approximately 6 in. to 8 in. The colour is bright green; young growth is generally bronze.

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* R. W. Hodgson, Associate Professor of Subtropical Horticulture, University of California. "Californian Avacado Industry." Circular No. 43 (April, 1930). Issued by the Californian Agricultural Extension Service.

The flowers are small and usually of a yellowish colour. They are borne on terminal racemes, possessing both stamens and pistil. Various reports from overseas authorities indicate that the fruit of the cultivated species are extremely variable in size, shape, colour, and other characteristics, varying in size up to over 3 lb. In shape they may be round, oval, pyriform, or any of the numerous gradations between these forms. The colour ranges from light yellowish-green, through dark green, maroon, brown, and reddish-brown, to purplish-black. The skin is thin and membranous in *P. drymifolia*, while in *P. americana* it is thick and tough, varying greatly in different varieties.

The fleshy, edible part, lying between the skin and the seed, is of a buttery consistency, cream to bright yellow in colour, often greenish near the skin. Each fruit normally contains a single large seed. The seed is inverted in the fruit so that the base is on the side away from the stem. Most, if not all, of the fruits produced in New Zealand are pyriform or between pyriform and oval in shape and vary in length from about 2½ in. to 5½ in., with a maximum diameter of approximately 3¼ in.

This savoury fruit has a nut-like flavour, and is most commonly used either as a green salad ingredient or, when mashed and seasoned, as a sandwich filling. It can also be served on plain biscuits or on toast.

NUTRITIVE AND DIETETIC VALUES.

The composition of the avocado is remarkably different from other fruits used in the fresh state. It has been shown by various overseas workers (R. W. Hodgson) that its average protein content (2·1 per cent.) is approximately three times that of the ordinary fresh fruits. Whereas most fruits contain little or no fat, the average in the avocado is 20·6 per cent. The caloric or energy value of the edible portions of the commonly used fruits is low, ranging from a minimum of 175 calories to a possible maximum of 400 calories per pound. The average for the avocado, as determined by Jaffa and Goss, is 1,056 per pound, or two and a half times the maximum for the other fruits, and far in excess of that of lean meat. From these facts it is evident that this fruit contains nutritive values far exceeding those of other fresh fruits.

CLIMATIC AND SOIL REQUIREMENTS.

The cultivated varieties of the avocado are subtropical fruits, and their culture is therefore limited to localities of relatively mild winters, such as are experienced in the warmer coastal regions of the Auckland Province. Observations on the behaviour of the avocado in New Zealand, supported by evidence from overseas countries, indicates that it will thrive on a wide range of soils. The character of the subsoil is perhaps of the greater importance, since perfect drainage and an absence of impervious clay or hard pan for a depth of 3 ft. or more appears to be imperative. Evidence in support of this belief lies in the fact that several dozen seedling trees planted near Warkworth over an impervious clay subsoil all failed to develop into mature trees. In general it can be taken that for the varieties of avocado generally cultivated the climatic and soil requirements are somewhat similar to those of citrus fruits.

PROPAGATION.

Like most other fruits, the avocado cannot be depended upon to reproduce true to type when raised from seed. Consequently, stocks are raised from seeds of hardy varieties, and when of sufficient size these are budded in the same way as citrus trees. While the operation of budding is a simple one, the results obtained are often disappointing, in that frequently many buds fail to take, even when the work is done by an expert operator.

PARTICULARS OF TREES GROWING IN NEW ZEALAND.

The four trees established at Tauranga, referred to earlier in this article, were planted in the year 1919. They consist of one tree each of the following four varieties: Lyon, Northrop, Harmon Abouacate, and Miserve.

Lyon.—This tree commenced cropping four or five years after planting, and has borne light to medium crops almost every year since that date. The tree is now about 35 ft. high. The fruit is small, weighing about 3 oz. to 4 oz. The seed is relatively large, and the flavour does not compare favourably with other varieties grown in New Zealand.

The other three varieties growing at Tauranga have blossomed profusely for many years past, but have never set any fruit. The variety Miserve is the only tree to be affected at all seriously by frosts, and consequently is much smaller than the other three trees.

Fuerte.—The only tree of this variety known to the writer is in a private garden at Feilding. The tree was budded on to a seedling stock, where it now grows, seven years ago. It has a height of 16 ft. and a spread of 10 ft. The tree has flowered profusely for several seasons past, but no fruit has set to date, unless during the present season.

Two trees of unnamed varieties were imported from Honolulu in the year 1929 and planted at Kerikeri, North Auckland. They attained a height of 14 ft. four years from planting. The trees were then cut back severely for the purpose of shifting to another position. They made a good recovery, and are now 9 ft. in height. No fruit has yet been produced.

Numerous seedlings of the Lyon variety have been distributed from Tauranga to various parts of the North Island. Most of these seedlings have met with little success, many having died a few years after planting. However, two of these trees, which are situated at Thames and are now ten years old, have in recent years commenced to bear fruit.

Two avocado-trees in New Zealand which have borne fruit, other than the Lyon variety, are in a commercial orchard at Ormond, near Gisborne. In this orchard there are four trees that were raised about twelve years ago from seeds imported from California, and of unknown variety. These trees have all made vigorous growth, and have never suffered to any appreciable extent from frost injury. One tree (hereafter referred to as No. 1) commenced to bear fruit eight years after planting, and another (No. 2) one year later. The other two trees have flowered profusely for several seasons without setting any fruit. The soil in this orchard is a fertile clay loam, with good natural drainage. Another tree raised from the same consignment of seed is situated in a narrow valley about ten miles inland from Tolaga Bay, and has made poor progress on account of severe frost injury on numerous occasions.

Tree No. 1.—This tree is now bearing its fifth successive crop, the two heaviest crops being estimated at between fifty and eighty fruits. Most of the fruits matured to a suitable size for commercial use, being approximately 5 in. long with a diameter of 2¾ in., and pyriform in shape. The flavour is rich and aromatic; the seed is relatively small with a close-fitting seed cavity; and the colour of the skin when fully ripe is purplish-black. The harvesting period extends from the first week in October until the end of the year, and possibly later.

Tree No. 2.—During the 1933-34 season this tree brought to maturity some forty fruits, and only a few fruits in both the two previous seasons. It is slightly larger than and of a similar flavour and colour to the fruit borne on tree No. 1. The seed is relatively small, and the seed cavity close-fitting. The shape is between pyriform and oval. The season of ripening is not known exactly. However, fruits have been harvested in good marketable condition from early January until the end of August. The fruit of this tree is about three months later in reaching maturity than tree No. 1.

Tree No. 1 corresponds very closely with the description of the Fuerte variety (as supplied by R. W. Hodgson), and is probably a seedling of that most popular variety. Likewise, tree No. 2 is similar to the description given of the Puebla variety, and so is in all probability a Puebla seedling. These two varieties are reported to be planted for commercial purposes in the United States of America more extensively than any other varieties.

The trees of thirteen named varieties were imported by the late Mr. A. Allison and established in his garden at Wanganui. Most of these trees were introduced in 1925 and in 1927, although several years earlier he had raised a number of seedlings, and at least one tree was successfully budded with the Fuerte variety in 1923. In 1931 this excellent collection of varieties was reported to be making vigorous growth, very few trees showing any appreciable injury from frost. Varieties that flowered in the 1930 season were Fuerte, Puebla, and Northrop. So far as can be ascertained, none of these varieties set fruit. Following the death of Mr. Allison, the entire collection was sold by auction, buyers participating from various parts of the North Island. No further record of these trees is available.

A nurseryman reports having grown avocado-trees at New Plymouth which flowered for a number of seasons, but failed to set any fruit, and were later destroyed. It is not known whether these were seedlings or propagated trees of named varieties. It is also reported that seedling trees of the Mexican strain have been grown at a station on the Wanganui River for the past twenty-five years. Some of these trees have fruited, but the quality is said to be poor.

POSSIBILITIES.

From the foregoing it appears that, while the trees of many varieties will withstand the winter temperatures experienced at least as far south as Feilding, latitude 40° S., it is only in the milder coastal areas of the Auckland Province that fruit can be expected to develop on varieties suitable for cultivation. Moderate crops have been reported from Thames, Tauranga (latitude 38° S.), and Gisborne (39° S.). The only named varieties known to have been tried out in such warm areas are at Tauranga, and these, unfortunately, do not include the leading commercial varieties. The fruit is practically unknown in New Zealand at the present time, although small consignments are occasionally imported from California and the Pacific Islands. These fruits usually retail at prices ranging from 6d. to 1s. 6d. each according to quality.

It appears that there are commercial possibilities in the growing of this fruit in suitable localities in the northern portion of the North Island of New Zealand. However, there is need for much more work in the matter of testing the suitability of various varieties, soils, and locations before planting on an extensive scale is undertaken.

The writer wishes to express appreciation for the valuable information concerning avocado-trees in New Zealand kindly supplied by the following Orchard Instructors: Messrs. A. R. Grainger, Tauranga; L. Paynter, Auckland; and J. W. Whelan, Palmerston North. Also the late Mr. H. F. Frost, formerly Orchard Instructor, Masterton.

CERTIFICATE OF RECORD.

THE Jersey cow Pukeroa Wheaten Wafer, bred and tested by Mr. F. Geck, Te Kauwhata, recently qualified for Certificate-of-Record in the 305-day division of the C.O.R. test on a production of 12,853·9 lb. milk containing 700·76 lb. fat, average test 5·45 per cent. She was 3 years 165 days old at date of calving for commencement of record, being born on 3rd September, 1932. The performance of Pukeroa Wheaten Wafer is the highest to date in the 305-day class, not only for the Jersey breed, but for all breeds participating in the C.O.R. test.

PUKEROA WHEATEN WAFER.

[N.Z. Farmer Weekly photo.

IRRIGATION IN CENTRAL OTAGO.

DUTY OF WATER.

G. G. CALDER, Instructor in Agriculture, Alexandra.

"DUTY of water" is the term used in defining the total amount of irrigation water used on the land to produce successfully any given crop. The duty of water is said to be high or low depending on the amount of water used. On a given soil type and crop a high duty of water is obtained under careful and efficient management or a low duty of water under careless and wasteful management where the consumption of water has increased.

FIG. 1. THE CROP OF UP-TO-DATE POTATOES GROWING ON THE LIGHT SANDY LOAM UNDER IRRIGATION AT ALEXANDRA

Since so many factors come into play when determining duty of water it is impossible to lay down any hard and fast rules regarding it. Apart from the different requirements of different crops there are large variations in the water-holding capacity of the soils and subsoils themselves.

It has been shown(1) that soils composed of fine particles—*i.e.*, clays and silts—can absorb and hold a definitely greater volume of water than soils composed of coarser particles such as fine gravels and sand. Consequently the latter type requires more frequent but smaller irrigations than the former. Further, the depth of soil, presence of a hard pan or an open gravel subsoil all necessitate using different amounts of water when irrigating to obtain a high duty of water.

With a good depth of soil a large volume of water can be used and the surface soil saturated: there is a downward movement of water, which, however, rises again by capillary action after the moisture near the surface has been used. Where a pan is present smaller quantities of water must be used, otherwise one gets water-logged conditions of the soil. A gravel subsoil, while supplying ideal conditions for drainage, is also a natural sink into which all excess irrigation water is lost, as there is no return movement of this water by capillary action. Consequently, to get a high duty of water here, only sufficient irrigation water should be used to meet the current requirements of the crop or the water-holding capacity of the soil without penetrating into the shingly subsoil. In a previous article(2) the low duty of water is seen on the 52-acre farm mainly due to the fact that the shingly subsoil reaches, or is in close proximity to, the surface over a comparatively large area of the farm.

Evaporation from a wet-soil surface is much faster than from a free-water surface. The average loss from a free-water surface at Alexandra for the period of three years—1933, 1934, and 1935—is 31·7 in. per annum. Since a loss such as this is often as much as and sometimes more than the irrigation water applied to the land, some measure must be taken to conserve the irrigation water. A cereal, grass, or lucerne crop supplies a natural cover to stop excessive evaporation, but when a crop, such as potatoes, mangel, maize, or carrots is grown in drills, then the soil requires mulching. This mulching or loosening-up of the surface can be done with a cultivator or horse hoe: it retards the capillary movement of the moisture to the surface and to a large extent checks evaporation. At Galloway Experimental Area(3) it was found that where the ground had not received cultivation till eight days after irrigating the water lost by evaporation was in the vicinity of 2 in. On adjacent ground where surface cultivation had been carried out after irrigation the loss amounted in eight days to ½ in.

The size of the total irrigated holding is reflected in the duty of water. As shown in the previous article referred to(2), a small area can be irrigated more economically than a large one, provided the soil type is the same, inasmuch that a smaller head of water is required and the work of distribution can be carried out more effectively.

The system of irrigation used is also a big factor in determining whether the duty of water will be high or low, since some systems are more efficient than others.

RAINFALL FOR SIX-MONTHLY PERIOD, OCTOBER TO MARCH AT ALEXANDRA.

As can be seen from the following data, the average rainfall for each wet day was so light at Alexandra during the period specified as to be of practically no value to the land:—

Season.	Rainfall.	Number of Wet Days.	Average Rainfall per Wet Day.	Annual Rainfall for Year ending 31st March.
	Inches.		Inches.	Inches.
1934–35 ..	7·43	45	0·16	14·25
1935–36 ..	5·16	51	0·10	9·28

The following table represents actual figures taken out on the duty of water over the past two seasons within a radius of five miles of Alexandra:—

Crop.	Soil Type.	Area in Acres.	Method of Irrigation.	Number of Irrigations.	Volume of Water used for Irrigation.	Total Water used, in Inches per Acre.	Yield per Acre.	Duty of Water per Ton.
						Inches		Inches.
1. King Edward potatoes	Medium to heavy schist loam	4·0	Furrow ..	4	2 cusecs for 24 hours	47·5	13 tons ..	3·6
2. King Edward potatoes	Medium to heavy schist loam	1·8	Furrow ..	4	1½ cusecs for 24 hours	78·64	17·07 tons ..	4·6
3. Epicure potatoes ..	Light sandy loam ..	0·320	Furrow ..	5	½ cusec for 8 hours	60·0	6·5 tons ..	9·2
4. Up to Date potatoes	Light sandy loam ..	..	Furrow ..	5	½ cusec for 8 hours	60·0	8·75 tons ..	6·85
5. Millet	Medium schist loam ..	2·5	Flooding from contour race	2	1 cusec for 60 hours	47·52	Not available ..	..
6. Mangels	Heavy schist loam ..	2·74	Furrow ..	4	¼ cusec for 36 hours	17·34	50·5 tons ..	0·34
7. Lucerne hay ..	Light shingly soil ..	3·0	Flooding from contour race	6	2 cusecs for 24 hours	95·0	18 tons hay ..	5·2
8. Lucerne hay ..	Medium schist loam ..	20·0	Border dyke ..	6	4 cusecs for 24 hours	28·51	5 tons silage and 3·3 tons hay	5·2
9. Lucerne hay ..	Light and shingly ..	10·0	Border dyke ..	6	5 cusecs for 24 hours	71·28	5 tons silage and 3·2 tons hay	5·2
10. Oats	Medium to light shingly loam	4·75	Flooding from contour race	3	1 cusec for 8 hours (once), 2 cusecs for 24 hours (twice)	21·6	1·25 tons chaff ..	17·2
11. Wheat	Medium to heavy schist loam	11·0	Flooding from contour races	1	2 cusecs for 72 hours	12·9	*40 bushels ..	0·32 (per bushel).

* Estimated yield was 40 bushels per acre The crop was sown on 13th August, 1935, and was a mixture of Dreadnought, Hunters, Pearl, and Tuscan, and in the uneven ripening a fair proportion of the grain was shaken. Six weeks of steady frosts after sowing delayed germination and caused rotting of over 50 per cent of the seed, thus producing rather a thin crop.

Potatoes.—Although the four potato crops are not strictly comparable, still they serve to demonstrate the variations that occur under irrigation. Crops Nos. 3 and 4 required an extra irrigation, due to the light soil type with a lower moisture-holding capacity. In the "Total water used" column crop No. 2, although on heavy land, has had the most water, but has made up for that fact by producing the heaviest

FIG. 2 THE MIXED WHEAT CROP WITH ESTIMATED YIELD OF 40 BUSHELS ON THE DUNSTAN FLAT

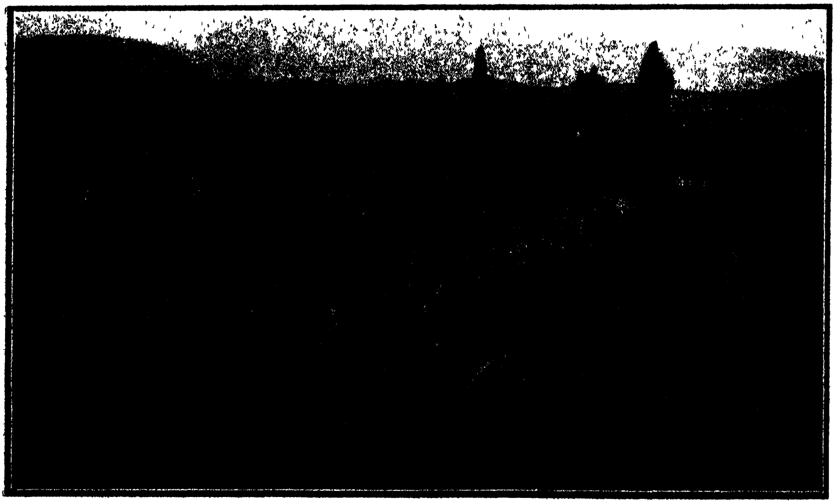

FIG. 3. THE OAT CROP.

Note the good growth of red clover which was broadcast after the oats were sown.

yield, while in the " Duty of water per ton " column the figures appear reasonable when the soil types and yields are taken into consideration.

Lucerne Hay.—In crops Nos. 8 and 9 the first cut from these areas was made into silage, giving approximately 150 tons, the remaining three cuts were made into hay, and produced 96 tons. The " Total water used " gives a good indication of the soil type and its water-holding capacity for the three crops. The " Duty of water " figures for hay are not comparable, due to the production of silage.

Millet.—To the writer's knowledge this is the first season that millet has been grown in Central Otago, when four crops were grown. This season has demonstrated that millet can be successfully grown, and has a place in irrigation farming.

Oats.—Two irrigations of 2 cusecs were required during the growing-season, due to the light soil type. The irrigation of 1 cusec for eight hours was accidentally given when the water-race broke away, and only part of the area received this water.

Wheat, being on a better soil type than the oats, required only one irrigation, and a quantity of, say, 4 to 6 acre/inches of water may have been sufficient, but as there had not been enough rain to either consolidate the ground or cake the surface the soil was comparatively loose and free, and 4 in. to 6 in. of water could not have been spread over the paddock. It required 2 cusecs running for three days to cover the field.

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(1) WIDTSOE : Principles of Irrigation Practice
(2) CALDER Survey of Production of Irrigated Farms on Galloway Flat. *N.Z. Journal of Agriculture*, January, 1936
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SMALL - FARM SETTLEMENT ON RECLAIMED TIDAL FLATS, WHANGAREI HARBOUR.

R. P. HILL, Fields Instructor, Auckland.

ON the shores of Whangarei Harbour there is an area of land known as Pohe Island reclamation. Some ten years ago the Whangarei Harbour Board erected stop-banks and dug some main drains(1). Three years later the Department of Agriculture carried out experiments in the grassing of a portion of this land, some 16 acres being made available for this purpose. More open drains were dug, and the land was also underdrained. In the underdraining narrow drains were scooped out with a draining-spade about 2 ft. 6 in. deep at intervals of 2 chains apart. These drains all led into the main drains, and reached right back into the area to be drained, and were later filled in with about 1 ft. of manuka, and finally covered with earth By this means half the area was underdrained and half was not. In December, 1928, the land was ploughed and fallowed until March, 1929, when it was cultivated and laid down to pasture. The establishment of pastures was much more rapid on the underdrained portion, although grasses and clovers eventually established

(1) C. J HAMBLYN : " Pasture Establishment on Reclaimed Tidal Flats. See this Journal, August, 1932.

on the undrained area and the general establishment was so encouraging that it was realized that this was land that could soon be expected to carry dairy herds.

The total area of Pohe Island is approximately 100 acres, the soil is not uniform, portions of it being a stiff mud clay, and the balance a mixture of sand and clay overlying beds of pipi shells, with small areas of a silty nature—with the exception of this latter type, none of these soils crack much when drained. The experimental grassing having been so encouraging, it was decided to proceed further with the work, using unemployed labour.

In December, 1932, under the Small Farms Board Scheme, Pohe Island reclamation was subdivided into four sections and settled with unemployed families by the Department of Agriculture. Cottages were erected for each settler, and further areas were ploughed and disked and grass-seed sown in March, 1933.

At present the settlers are paying their way, this including paying rent on the land and interest on the capital expended on the holding. It must be remembered that before settlers were eligible to occupy these holdings they had to show that they had no assets.

The settlers, once in occupation, ploughed and sowed down to pasture further areas of their sections, using the same seed-mixture as that used by the Department of Agriculture, until by now very little further grassing remains to be done. The land did not dry out uniformly, and consequently this meant that further small drains had to be laid by the settlers themselves before ploughing could be undertaken. On a small area which, when the time was ready for ploughing this year, was still too wet to plough, the following treatment was adopted : Hay was fed over the area, and the tramping of the hoofs of the cattle broke the surface of the soil ; the settler later scattered more rye-grass and clover seed, and the whole is now showing an excellent strike of pasture. Splendid vegetable-gardens have been established and fruit-trees planted, which are now coming into bearing, and each man has also been kept busily employed erecting further subdivision fences, grubbing rushes where necessary, building bridges and culverts, and top-dressing and harrowing, until at the present time beyond planting shelter, there is very little further development work to be done.

This area is somewhat exposed to the cold winds. Already quite a quantity of pampas-grass has been planted and has made splendid growth. Rows of pampas along subdivision fences would not be costly : young seedlings can be obtained close at hand and a very inexpensive protection fence could be provided by using 3 in. barbed wire. Two or three of these wires strained tightly with one post to the chain and a few stakes between make an absolutely effective cattle fence, even holding back yearlings.

Flax also quickly makes excellent shelter on this class of land.

The land is now carrying good pastures, in which perennial rye-grass, strawberry clover, and white clover are dominant, with red clover, crested dogstail, paspalum, and cocksfoot sub-dominant. Throughout the summer months these pastures " threw " an enormous amount of feed, and the settlers have saved ample quantities of hay for the winter : one settler actually sold hay. It has also been found possible to close up fields this winter for early-calving cows. The stock are all looking well, and the fact that they are being carried at the rate of nearly a

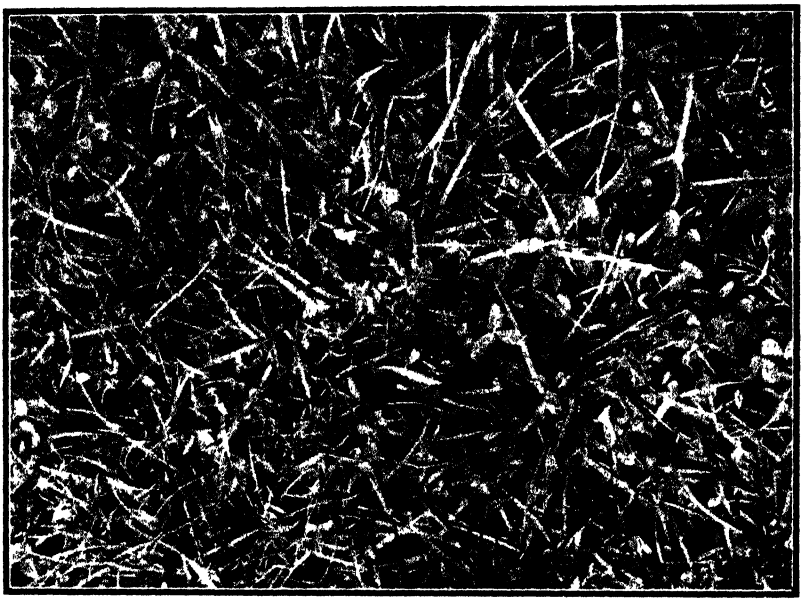

FIG. 1. MIXED PASTURE, PERENNIAL RYE-GRASS, WHITE CLOVER, AND STRAWBERRY CLOVER, FOUR YEARS OLD.

FIG. 2. STRAWBERRY CLOVER COVERING BARE GROUND.

This clover has spread rapidly from the grassed areas to undeveloped portions of reclaimed tidal flats.

beast to the acre of actual pasture speaks well for the land and the management. Last season the butterfat-production varied from 140 lb. to 180 lb. per acre, and there is no reason to doubt that in a short time this will be increased to 200 lb. and over an acre.

The growth of clover has been phenomenal, more especially on the mud-clay soils, where red clover and white clover have been particularly strong, and trouble with bloat has been experienced. The most satisfactory fertilizer has been superphosphate or superphosphate and lime, and to reduce the bloat a settler has been adding small quantities of sulphate of ammonia with the idea of depressing the clover. A better remedy possibly would be the more frequent use of the mower, closing up either for hay or silage, or to mow the clover and allow it to wilt before feeding to cows.

A very satisfactory feature of the establishment of pastures is the growth of strawberry clover, more especially on the sandy and silty soils: these soils are liable to dry up badly in the summer heat, and the strawberry clover, having a deep rooting system, makes strong growth all through these months when the white clover tends to dry out.

These lands grow excellent crops of mangels and turnips, and with the prolific summer growth of pasture, enabling plenty of hay and silage to be saved, the settlers are more inclined to rely on all-grass farming. On small areas and with limited capital the providing of sufficient horse-power and the necessary implements for cropping is not an easy matter. Considering the fertility of the land, however, probably they would be wise to grow a small area of maize each year for seed purposes—maize, to carry their pigs with some grass over the periods when there is no milk, is very valuable, as it enables some pigs to be kept through the winter ready to start fattening immediately the milk-supplies are available, which is preferable to buying-in pigs for this purpose when all pigs are dear to buy. Maize would also reduce their poultry bill considerably.

There are many more tidal areas which could be reclaimed and settled in a similar manner. It must be remembered, however, that reclamation is not a rapid process: main drains and stop-banks must be erected many years before it is attempted to grow grass, and, to remove the salt quickly, underdraining is essential.

In the Kirikopuni district areas of reed sweet grass, glyceria (*Poa aquatica*), have at some time been established in wet, swampy places and along creek-beds, which dry out somewhat in the summer. During an inspection of these areas the highly palatable nature of the feed produced was very noticeable. The surrounding pasture, which consists of paspalum and white clover, had been neglected by the cattle, become rank, and was of a dark colour. The *Glyceria aquatica* areas were being continually grazed, and their paler green colour could be seen from the surrounding hills, thus outlining the creek-beds winding along the flats.

—*Fields Division.*

STRANGLES.

G. K. L. KNOTT, Veterinarian, Live-stock Division.

IN view of the fact that spring is approaching, and with it the time for shows, sales, &c., it is most probable that outbreaks of strangles will occur in various parts of the country. The congregating together of horses, especially young stock, from diverse localities always facilitates the spread of the disease.

Strangles is an acute contagious disease of horses (and of all solipeds) characterized by a catarrhal inflammation of the mucus membranes of the nasal cavities and throat, and by abscess formation in certain lymph-glands, usually the submaxillaries (situated at the angle of the jaw). An atypical form of the disease also occurs commonly known as " bastard " strangles

The disease has been well-known and recognized for many generations in most countries where horse-breeding has been engaged in As far back as the beginning of the last century an investigator named Viborg proved that nasal discharges from affected animals are infectious to healthy animals by inoculation, and towards the end of the century Schütz established the importance of the *Streptococcus equi* organism in an affected animal.

The disease occurs in all parts of the world, excepting perhaps the Argentine. It is of interest, and perhaps significance, that the condition known as " roaring " is also supposed to be unknown in the Argentine. The incidence is usually greater in establishments where breeding is carried on, as in these circumstances there is a larger proportion of young stock.

The majority of cases occur in young animals, the most susceptible age being from two months to five years old. The smaller incidence of it in older horses is due either to an immunity gained from an attack of the disease in youth or to a greater natural resistance acquired with age.

CIRCUMSTANCES OF INFECTION.

There are many circumstances which may predispose towards infection, such as fatigue due to transport or long journeys, poor bodily condition or poor feed, hard work whilst immature, bad weather (the disease is more prevalent in autumn, winter, and spring) overcrowding in stables, bringing young horses bred in the country into cities where the different atmospheric conditions may upset the animal. Many other conditions may be added to these, but, in short, any circumstances conducive to a lowering of vitality render the animal more susceptible.

The organism, previously mentioned, which is the usually accepted cause of the disease is *Streptococcus equi*. Some authorities are of the opinion that there is another factor involved, probably an ultra-visible virus, their reason being that this organism is also found in other conditions not associated with strangles. The *Streptococcus equi*, however, is invariably present in affected animals.

CONTAMINATED FOOD.

The most common method of infection is by ingestion of contaminated food or water. As there is usually a copious nasal discharge, it is obvious that this contamination is easily brought about. It is also apparent how the congregating together of horses of all ages facilitates its spread—in fact, in some countries the condition is commonly known as "dealers' stables disease," &c. Communal horse-troughs are often a fertile source of infection. Flies or wind may play a part Stables grooming-tools, feeding-utensils, nose-bags, &c., may remain infected in spite of so-called disinfection. This latter must be very thorough to be really effective

The pus from discharging abscesses is also infective. and the disease may be transmitted in the semen during service. Foals may infect the mammary glands of their mothers whilst suckling, giving rise to a form of mastitis, or a mare with an infected udder may transmit it to her foal.

The period of incubation—that is, the time elapsing between infection and the appearance of the first symptoms—is from four to eight days.

THE SYMPTOMS.

The symptoms may be divided into two types—(*a*) Regular, which is fortunately the commonest type and (*b*) irregular.

Firstly, dealing with the regular type: Typical attacks commence with dullness, lack of appetite, and some fever, and the temperature rising to between 103° and 105°. The mucus membranes of the eyes and nose become inflamed, and a watery nasal discharge soon occurs. This becomes profuse, thick, and creamy, and there is often a similar discharge from the eyes.

Two or three days after the appearance of the first symptoms the submaxillary glands become hot and painful and begin to swell. They are at first tense and fairly hard, but after a few days have elapsed a soft. fluctuating point is usually discerned at the peak of the swelling, and rupture of the abscess at this point usually results. Some coughing is usually present, and during the process quite large amounts of phlegm and mucus are blown out.

Sometimes the parotid glands and not the submaxillaries become affected. The swelling in this case will be situated over the side of the throat, often nearly half-way up to the base of the ear. When this occurs the animal is subjected to greater distress and discomfort. The head will be held stiffly with the nose poked out in an effort to relieve the distress, as the swelling will in addition be bulging into the pharynx. Breathing and swallowing will be extremely painful, difficult, and often impossible. The laboured breathing greatly exhausts the patient and sometimes it is necessary to perform an operation, whereby the windpipe is opened, in order to relieve the distress.

STRAIN ON THE HEART.

In these severe cases there is a great strain on the general system and heart, and the mucus membranes assume a bluish tinge. Another danger when the abscess forms in this site is that it will burst inwards and perhaps be inhaled into the lungs, when a very fatal form of pneumonia will be set up. However, great relief results when the abscess is lanced at the correct stage of development or ruptures externally of its own accord, no matter whether it be in the submaxillary or parotid glands. From this point, providing there are no complications, there is a gradual return, through convalescence, to normal health. It is very essential that the animal should have a good spell even after all symptoms have subsided, as the internal organs, such as the heart, will take a considerable time to recuperate their normal health and strength.

Many different complications may occur during or as a sequel to an attack of strangles—chief amongst them are pneumonia and abscess formation in an internal organ. The tendons or tendon-sheathes may become affected, resulting in chronic contracted tendons. The joints may become the seat of abscess formation, causing lameness and irreparable damage. The udder in lactating mares may develop mammitis, due to the spread of the organism. The air sinuses of the head may become the site of chronic inflammation, giving rise to a persistent nasal "gleet" or discharge Those "sinuses" are air spaces in the head formed by certain porous bones. Another possible complication is a disease known as *Purpura haemorrhagica*. It is thought that an attack of strangles predisposes to whistling and roaring, stringhalt, and shivering, and to the common osteo-arthritic diseases of the joints and bones

IRREGULAR TYPES OF DISEASE.

The symptoms in the irregular type may be very diverse, depending on the organs involved. There is invariably present the inflammation of the nasal mucus membrane, but the submaxillary and parotid glands may remain normal or other glands become the seat of trouble, or the mesenteric glands, situated in the belly, giving rise to colic and fatal peritonitis when they rupture An abcess in the chest may affect the lungs or heart

The progress in the irregular type is usually less favourable. In the regular type it is quite hopeful, providing the animal is given reasonable treatment and good nursing. The most essential part of treatment is good nursing and hygienic surroundings.

The affected cases should be isolated, and care should be taken that the disease is not spread to healthy animals by grooming or feeding utensils, or by the attendant himself.

The patient should be well rugged up if the weather is not hot, but should be given plenty of fresh air. Lack of fresh air greatly increases the risk of complications. Clean drinking-water should be available and should be changed often as it soon becomes fouled by the nasal discharge. From 2 oz. to 3 oz. of Epsom salts may be given daily in the drinking-water. The animal is better not tied up, and should be allowed free use of his head. The nose and eyes should be kept clean by sponging out frequently. This prevents the discharge from "scalding" the skin. The swelling in the glands may be treated with fomentations, liniments, or a mild blister, in order to hasten the ripening of the abscess. When ripe—that is, when a definite soft doughy spot, which tends to shed its hair, can be felt—it should be lanced with a knife previously sterilized by boiling. There is a considerable danger of damaging a nerve or blood-vessel if this operation is performed too soon. After opening, the cavity should be syringed out daily with a disinfectant and the skin surrounding the wound kept clean. The cavity should heal from the bottom, and the lips of the wound should be kept open whilst this proceeds by inserting a clean plug of cotton-wool.

Avoid drenching the animal, as much damage may be done by it, and, in any case, very little good would result.

If the breathing becomes very thick relief may be obtained by inhalations of steam from hot water, to which has been added a few drops of turpentine, oil of eucalyptus, or Friars balsam

IMPORTANCE OF FEEDING.

The feeding of the patient is of importance. The bowels may be regulated with bran mashes. If the animal can swallow easily green foods may be given, or a little steamed hay, crushed oats, or, occasionally, sliced carrots. In any case, the food should be of a soft non-irritating nature.

If swallowing is difficult sloppy foods should be given—for instance, thin oatmeal or linseed gruel, hay tea, or milk and raw eggs. These things are best given in a bucket on the ground or placed in some low position as the chance of it " going down the wrong way "—down the windpipe-- is not as great when given thus. Any food not eaten by the animal should be removed and not left in front of him to become fouled.

In good warm weather the animal may be better out in the open providing some shade is available and that flies and dust can be avoided as far as possible

Subsequent to recovery a long rest is essential, and when work is resumed it must be done so gradually, otherwise serious and irreparable damage may be done to the heart or wind.

In severe and complicated cases professional advice should be sought, as special lines of treatment may be indicated to meet the individual requirements of the case.

Regarding prevention, predisposing causes already mentioned should be avoided as far as possible. When an outbreak occurs, strictly isolate the affected cases. At one time strangles was regarded as an inevitable complication in the rearing of young horses, and it was the practice to try to spread it to all the susceptible horses in the stable when an outbreak occurred. The object was to get the trouble over as soon as possible, as one attack renders the animal immune to subsequent infection. The practice is of doubtful value, and not to be recommended, as, apart from other factors, some authorities are of the opinion that at least 15 per cent. of recovered animals are affected in the wind.

SERUMS AND VACCINES.

There are certain serums and vaccines which are reputed to be capable of conferring, at any rate, a temporary immunity to the disease. These may be useful in protecting horses which are liable to be exposed to infection when coming into contact with horses from other establishments or districts, and they may also be of value as a curative agent in treatment ; but, so far, it can definitely be taken that there is no recognized specific inoculation, either as a preventative or curative, for this disease, and until the discovery of the causative agent is finally determined inoculations will of necessity be of a "hit or miss" nature.

Owners would be well advised to direct their efforts towards nursing, management, &c., rather than to the use of nostrums of questionable value.

CONTROL OF BROWN-HEART IN SWEDES.

J. W. WOODCOCK, Crop Experimentalist, and D. M MERRY, Assistant Crop Experimentalist.

FOLLOWING on results of field trials conducted in the 1935–36 season* further experiments have been carried out by the Fields Division during the past season to ascertain—

(*a*) The minimum quantity of borax necessary to control brown-heart:

(*b*) The effect of borax on seed-germination at various rates of application:

(*c*) The effect of the addition of lime to borated fertilizer mixtures on germination and control of brown-heart:

(*d*) The effect of applying borax broadcast before and after sowing.

The thirty-five trials laid down on swede crops were distributed throughout districts where brown-heart has been prevalent in the past.

METHODS USED IN TRIALS.

The Beaven half-drill strip method was adopted where comparisons of the various treatments with and without borax were included. This method, in which the manure-box is divided, allows one-half of the fertilizer to be sown with borax and the other half without Contrary to expectations the admixture of even small quantities of borax with fertilizer affected the rate at which the fertilizer was delivered, thus making the application of a stipulated quantity exceedingly difficult. The fertilizers used were of various types, including proprietary manures, farmers' own mixtures, and fertilizer plus lime mixtures. The method of sowing included 7 in. drills, 14 in. drills, and the 26 in. ridges usual in Southland. In several trials in which the ridger was used part of the fertilizer and borax was sown from the front box of the drill and part from the rear box, thus securing placement of part of the mixture below the seed.

APPLICATION OF BORAX.

Borax was mixed and drilled along with the fertilizer and seed in the majority of trials, and in these the amounts of borax applied were 3 lb., 6 lb., 9 lb., and 12 lb. per acre. In the remainder the material was broadcast at 8 lb. or 10 lb. per acre either prior to or immediately following drilling, while in a few of these broadcast applications were made at thinning, and also when the crop was half grown, in addition to the dressings given at seeding.

EFFECTS ON GERMINATION OR "STRIKE."

Observations were made shortly after the sowing of the trials to determine the extent of any detrimental effect on seedling development. Previous experience* had indicated that under certain conditions borax sown along with the fertilizer and seed could exert a certain amount of injury. The appearance of creamy-coloured cotyledons and a retardation of growth at the cotyledon stage are the general symptoms of this toxic effect. Under some circumstances, probably regulated by soil-moisture conditions, these symptoms may disappear at a later stage, but under conditions more unfavourable to growth many of the seedlings perish and cause a patchy "strike." Where the latter conditions were easily apparent in the experiments this fact was noted, although sometimes actual plant counts were taken.

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* WOODCOCK, J. W.: *N.Z. Journal of Agriculture*, Vol. 53, No. 2; August, 1936.

No germination injury or retardation of growth was apparent in any of the trials in which borax was *broadcast*, although in one, where it was applied at the thinning stage, further development was retarded.

When *drilled* along with fertilizer and seed, borax sometimes caused a reduction in the field germination. With the heavier rates of application—9 lb. and 12 lb. per acre—poor strikes were frequent and seedling development was retarded, this applying to fertilizer mixtures with and without the addition of lime.

The following table summarizes the general effect of borax in the trials in which the material was drilled with fertilizer and seed :—

Table 1.—Effect of Borax sown with Fertilizer on "Strike" of Swedes.

Effect on Strike of Different Quantities of Borax	Number of Trials
No detrimental effect from borax treatment	10*
3 lb., 6 lb., and 9 lb. had no effect ; 12 lb. was detrimental	1
3 lb. and 6 lb. borax had no effect, 9 lb. and 12 lb. detrimental ..	2
3 lb. had no effect, 6 lb., 9 lb., and 12 lb. detrimental	2
3 lb., 6 lb., 9 lb., and 12 lb. borax all detrimental	13†

* Includes six trials in which 8 lb. or 10 lb. borax were the only quantities used. † Includes two trials in which 9 lb. or 10 lb. borax were the only quantities used.

In several experiments not included in the above table germination on both treated and untreated areas was poor, and it was not possible on these to carry out counts or estimates with any degree of accuracy. Although various methods of drilling have not been investigated in any one trial a general review of the experiments indicates that more severe injury took place in the crops drilled 14 in. apart than those spaced in 7 in. rows or 26 in. rows (where part of the borated fertilizer had been sown below the seed).

EFFECT OF BORAX ON CONTROL OF BROWN-HEART.

Inspections of the crops were made just prior to feeding off and a number of roots (generally 50 or 100) on each treatment were taken at random and cut for examination. In seven trials no brown-heart was detected in any of the treatments.

Where borax was applied *broadcast* before sowing at 10 lb. per acre, control of brown-heart was satisfactory in five trials, while in two experiments the disease (slight in both cases) was not controlled by the treatment.

Table 2 summarizes the position in respect of brown-heart control where borax in various quantities was *drilled* with seed and fertilizer.

Table 2.—Summary of Results from Borax sown with Fertilizer on Incidence of Brown-heart in Swedes.

Degree of Control from Borax.	Number of Trials.
Trials free from brown-heart	4
Complete control or high degree of control from 3 lb., 6 lb., 9 lb., and 12 lb.	7
Complete control or high degree of control from 6 lb., 9 lb., and 12 lb. only	3
Complete control or high degree of control from 8 lb., 9 lb., and 12 lb. only	4*
Complete control or high degree of control from 12 lb. only ..	3
Moderate control from 3 lb., 6 lb., 9 lb., and 12 lb. borax	3
Brown-heart (all slight infection) not controlled by borax .. .	3†

* Includes three trials in which 8 lb. borax was the only quantity used. † Includes two trials in which 8 lb. borax was the only quantity used.

COMMENTS ON TABLE 2

Out of twenty-three trials in which brown-heart was present, borax gave a complete control or a high degree of control (reduced the infection by 70 per cent or more) in seventeen. In the three trials where borax had no effect and in one trial where control of brown-heart was only moderate, the infection was only slight, the number of infected bulbs being less than 5 per cent on the untreated plots in each case. This leaves two experiments in which fairly severe infection was only slightly reduced by borax.

Owing to early retardation of growth as a result of applying borax with manure and seed the swedes on treated areas were often small although free from brown-heart. However, in some trials it was noted that the "intensity" of brown-heart infection on individual roots was more severe on treated than on untreated drills. In one trial the infection was more severe on the drier knolls, while in another one located on two distinct soil types the incidence of brown-heart was several times greater on a peaty soil than on a friable loam; the addition of borax was effective on both soil types however.

SUMMARY AND RECOMMENDATIONS.

From the results of thirty-five trials carried out to investigate the effect of borax applied by different methods on control of brown-heart, it would appear that the method of mixing borax with fertilizer and sowing in intimate contact with swede-seed is open to some risk owing to a possible adverse effect on the "strike." This occurred in some instances with quantities of borax as low as 3 lb. per acre. The application of borax at 10 lb. per acre broadcast before sowing had no such adverse effect.

Satisfactory control of brown-heart was obtained from borax applications except in six experiments, in two of which neither drilling nor broadcasting had any effect. The incidence of brown-heart in four of these unsatisfactory trials was only slight. Of the trials in which borax was drilled, the application of 3 lb. or more per acre gave a high degree of control in seven, in three the minimum effective quantity was 6 lb., while in seven at least 9 lb. to 12 lb. appeared necessary. In one of the latter, whereas applications at 3 lb. and 6 lb. respectively were only slightly effective, 10 lb. of borax broadcast prior to sowing appeared as satisfactory as 9 lb. and 12 lb. applied in close proximity to the seed. Broadcasting the material at about the thinning-stage appeared to be equally efficient as broadcasting prior to seeding, although the latter should be preferable. When applied to crops about half-way through the growing-period, borax was generally less effective. The addition of lime to borated mixtures showed no advantage or detriment either as regards effect on " strike " or control of brown-heart.

In view of the possibility of injury to the establishment when borax is applied with the seed, wherever possible the material should be applied at from 10 lb. to 20 lb. per acre *broadcast* before sowing or shortly afterwards. To facilitate distribution it should be applied either along with sawdust or soil. If top-dressing is impracticable the drilling of 3 lb. to 6 lb. of borax per acre is less likely to cause severe injury than with the heavier applications, and from the evidence obtained this quantity is likely to have a fair measure of control. By sowing the crop in 7 in. drills, or by putting half the borated fertilizer below and half with the seed, as is possible with the ridger, the liability to injury is likely to be further reduced.

ACKNOWLEDGMENTS.

The field work in connection with the trials was carried out by Instructors of the Fields Division under the direction of Fields Superintendents at Hamilton, Palmerston North, Christchurch, and Dunedin respectively. Thanks are extended to the farmers who co-operated in carrying out the experiments.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published recently in the *New Zealand Patent Office Journal*, include the following of agricultural interest .—

No 78127 : Mower-driving means , C E Bailey No 78144 : Turnip-cutting tool ; W de M Lindop No 78150 . Manure-distributor ; G. R. Petch. No. 78152 . Teat-cup ; S. A C Gallichan and A C Kerr No 78156 : Plant-growing method ; W. Malone No 78169 . Sheep overall , Smith, Copeland, and Co , Pty No. 78192 · Shearing-machine comb-trimmer , J. B Anderson No. 78218 : Grassland cultivator , H. T. Gillies No 78229 : Cultivator , A. V Pettman. No. 78248 : Teat-cup ; C. F Laxton. No 78270 : Water-pump ; G. S. Foote. No. 78278 ; Milk-delivering means ; H. W Lee. No 78289 : Fencing-post ; A. Howard. No. 78292 · Fencing-dropper ; W. Stubbs.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

Silver poplar (*Populus nivea*) has been declared a noxious weed within the Borough of Matamata.

Phalaris arundinacea has obtained a good footing in a swamp at Kopuka, and rivals *Poa aquatica* in its aggressiveness in the swamp, yet providing more palatable and earlier feed. It is ousting blackberry and rushes. It appears to be more aggressive than *Poa aquatica* on the less wet parts of the swamp and it is expected that it will prove a valuable addition to the swamp grasses in the lower Waikato Basin.—*Fields Division.*

WINTER GRASS.

F. R. MARRYATT, Ruakura Farm of Instruction, Hamilton

WITHOUT nitrogen grass will not grow. When the soil is warm, growing clover supplies nitrogen to grass, and at that stage artificial nitrogen is not economical. In the winter, however, when the soil is cold, and normally clover is growing very feebly artificial nitrogen may be profitable when correctly used.

ARTIFICIAL NITROGEN, PLUS SUPER, FOR WINTER GRASS.

The correct use of artificial nitrogenous fertilizers, particularly sulphate of ammonia, demands prior and adequate phosphating and liming of the pasture , at least 3 cwt. of each to the acre every year is necessary. Artificial nitrogenous fertilizers may be applied between April and August, but for winter grass they should be applied in April or early May, and, particularly, only when the grass is still growing and when it has some little growth--say, 2 in. Keeping stock off the treated pasture until the growth has reached about 9 in. is equally as important. The top of the spelled pasture should then be grazed off, leaving about 3 in. ungrazed. Do not graze bare. Then spell the pasture again.

USE OF SUPERPHOSPHATE ALONE.

When sufficient clover in a pasture has been growing vigorously for a month or two prior to the winter, it will continue to supply some nitrogen to the grass even when the soil becomes fairly cold. If the clover has been refreshed by a March or April top-dressing of super and thereafter spelled from grazing, it will provide the most nitrogen possible. It will continue to supply some nitrogen to the grass even when the soil becomes very cold.

In order to allow a growth of grass for the winter, hay and other supplements must be fed out before they are actually required. Feeding out normally begins when pastures have been grazed bare ; but to grow winter grass feeding out must begin some weeks before it is actually necessary. Only in this way can fields be closed up while the grass is still growing.

BOTH METHODS AT RUAKURA.

This year both methods of providing winter grass have been tried at Ruakura.

Transport difficulties unfortunately delayed the application of nitrogen. The sulphate of ammonia was not applied until the 7th June. By this time the pastures had been spelled since the 19th April—forty-nine days of mild " growthy " weather. The growth averaged 6 in. Still more unfortunately, hard frosts followed. Frosts of 6·4 degrees, 16·7 degrees, and 7·4 degrees were recorded on the first three nights. Little improvement due to the nitrogen can therefore be expected until after the first grazing-off ; no differences have yet been seen. On the 14th July the growth averaged 8 in.

On the other hand, the superphosphate treatment ran to schedule, and the weather was favourable. The superphosphate fields were also closed to stock on the 19th April, being top-dressed with superphosphate and lime on the same day. The growth on the 14th July averaged 8 in.

Both sulphate of ammonia and superphosphate treated pastures are to be grazed immediately. They are to be grazed down as evenly as possible to about 3 in. or 4 in. The aim is to let the light in to the clovers, and also to prevent the undergrowth from decomposing and becoming not only unpalatable, but also quite useless.

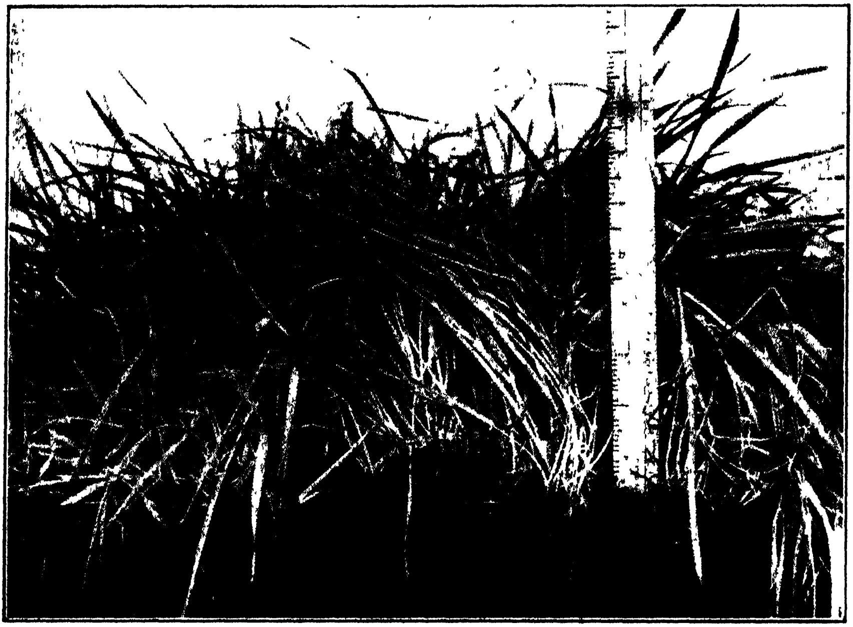

FIG. I. SIDE VIEW OF TURF REPRESENTING THE PASTURE ON 13TH JULY, 1937.
Pasture consists mainly of fog, rye-grass, cocksfoot, and white clover.
[*Photo by H. Drake.*

FREE NITROGEN COMPARED WITH PURCHASED NITROGEN.

The most obvious and important difference is one of cost. This will be the difference between the total cost of applying the artificial nitrogen and the value of the return of growth over and above that returned by superphosphate alone. Management and the season together will decide whether the cost will be returned. The weather is very important—for example, this autumn and early winter was very mild and favourable to natural nitrogen ; clovers grew well and supplied plenty of nitrogen to the grass. . Grazing management is also very important, and the Ruakura grazing trials have been arranged to teach us something about it.

Other differences between artificial and natural nitrogen-grown grass are comparatively unimportant, but they are interesting All artificial nitrogen is not fool-proof; superphosphate is. On the other hand, artificial nitrogen-grown grass does not "winter-burn" as does natural nitrogen-grown grass Again, response from superphosphate is spread out over a longer period than is that from applied nitrogen. Against this, however, in natural nitrogen-grown grass shut up for a long time, partial decomposing of the undergrowth may occur; but suitable grazing management is expected to overcome this difficulty.

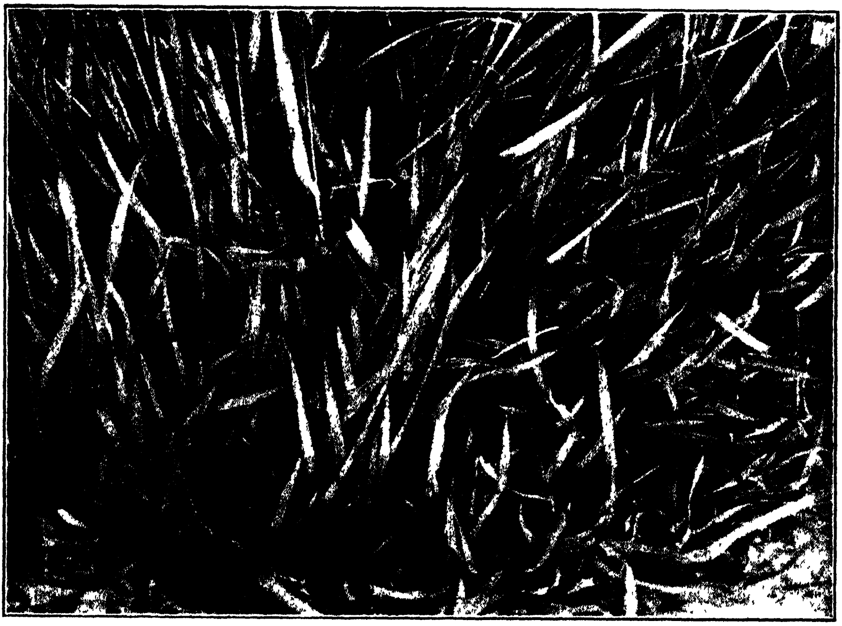

FIG 2 TOP VIEW OF TURF IN FIG 1

Pasture shut up on 19th April, photo taken on 13th July, after eighty-five days' spelling Commencing on the 19th July, forty-six P.A cows and forty-six P.A calves of mixed ages and sizes grazed the winter-spelled area of 7¾ acres for eight full days. There was then from 3 in to 4 in of herbage ungrazed.

[*Photo by H. Drake*

CONCLUSION.

Without nitrogen grass will not grow. Clovers and live-stock supply enough nitrogen to grass on most New Zealand pastures, except in the winter. Winter grass may be grown either by buying artificial nitrogen and putting it on the pastures, or by giving the clovers every opportunity to carry on their good work. Both methods are good. The season itself will decide whether purchased nitrogen pays.

There is a big interest being taken in subterranean clover in the Marlborough District. Many farmers have placed large orders for the seed. The seed sold so far is of local production, the Australian product not yet having arrived An idea of the magnitude of some of the orders may be gleaned by one of thirty 200 lb. sacks—sufficient to sow down 1,500 acres. This seed is going on to a back-country run, where it should be very beneficial. —*Fields Division.*

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY FACTORY AVERAGES FOR THE YEAR 1936 37.

BUTTER-MANUFACTURING companies which have obtained an average grade of 94 points or over and cheese-manufacturing companies which have obtained an average grade of 93 points or over are listed below. Of the total of 182 creameries and dual-plant factories manufacturing butter for export, thirty-four are included in the list, as compared with thirty-two for the preceding year, and of the 297 cheese-factories and dual-plant factories manufacturing cheese for export, twenty-two, as compared with twenty for the previous year, have averaged 93 points or over. Of the total factories listed, twenty-six butter and thirteen cheese are situated in the North Island and eight butter and nine cheese in the South Island.

Company or Proprietor	Registered No.	Brand.	Tonnage graded.	Average Grade.
		Butter-factories.		
T and P Milk-supply Co., Ltd.	54	Sweet Briar, &c.	27	94·959
Rangitikei Co-op	1360	Rangitikei	686	94·826
Murchison Co-op.	1888	Airship	262	94·778
United Co-op	1296	Wharini	279	94·752
Kaikoura Co-op.	302	Kai	220	94·751
Rodney Co-op	394	Rodney	438	94·684
Collingwood Co-op	1254	Golden Hills	226	94·654
Awahuri Co-op.	664	Red Rose	850	94·635
Rangiwahia Co-op	750	Quail	150	94·629
Taihape Co-op.	1188	Tikapu	535	94·542
Eketahuna Co-op.	46	Eketahuna	181	94·474
Rata Co-op.	938	Rata	1121	94·430
Northern Wairoa Co-op.	4	Northern Wairoa	624	94·390
Levin Co-op	910	Lake	1573	94·367
Karamea Co-op	302	Karamea	224	94·340
Ruawai Co-op.	66	Ruawai	1681	94·308
Golden Bay Co-op	146	Sovereign	721	94·280
Cheltenham Co-op	3	Pakeha	2172	94·253
Shannon Co-op.	1489	Shannon	1232	94·241
Maungaturoto Co-op	1407	Otamatea	1153	94·230
Uruti Co-op.	300	Uruti	257	94·219
Rongotea Co-op.	8	Rongotea	1012	94·209
Lepperton Co-op	49	Lepperton	176	94·177
Wangaehu Co-op.	1326	Wangaehu	640	94·150
Inter-Wanganui Co-op	6	Inter-Wanganui	187	94·149
Municipal Milk Department, Wellington	202	Rahui	128	94·131
Piopio Co-op.	603	Piopio	475	94·111
Tolaga Bay Co-op.	1007	Tolaga Bay	281	94·055
Masterton Co-op.	1307	Masterton	888	94·037
Kuku-Manakau Co-op.	905	Ohau	236	94·028
Arahura Co-op.	1516	Arahura	79	94·027
Takaki Co-op.	1463	Bell	562	94·023
Kaikohe Co-op.	40	Kaikohe	308	94·013
Kaipara Co-op	794	Popular, Filbert	2506	94·012

Company or Proprietor	Registered No.	Brand	Tonnage graded	Average Grade.
		Cheese-factories.		
Kaimata Co-op.	992	The Oaks	391	93·732
Rai Valley Co-op	519	Rai Valley	314	93·691
Milton Co-op	1030	Milton	105	93·601
Omimi Co-op	74	Omimi	59	93·547
Little Akaloa Co-op	32	Little Akaloa	55	93·468
Stirling Co-op.	292	Stirling	329	93·307
Westmere Co-op.	1621	Westmere	356	93·276
Cardiff Co-op.	10	Cardiff	662	93·269
Stratford Co-op	219	Huinga	303	93 210
Wairewa Co-op.	471	Wairewa	144	93·203
Mangawhata Co-op	1343	Mangawhata	362	93·202
Parkvale Co-op.	1240	Parkvale	306	93·180
Royal Oak Co-op	693	Royal Oak	137	93·163
Titiroa Co-op	361	Cloverpark	130	93·159
Kahui Co-op	493	Kahui	280	93·115
Waikaka Co-op	1067	Waikaka	27	93·104
Kaponga Co-op	1696	Rowan	381	93·084
Dannevirke Co-op	391	Dannevirke	188	93·070
Cam Co-op	168	Cam	95	93·067
Rapanui Co-op	1714	Southern Grove	121	93·065
Pembroke Co-op.	234	Pembroke	383	93·046
Jolls, T L, Co-op	1862	Maori Chief	468	93 042

Dairy Division.

NOTES ON RECENTLY OBSERVED EXOTIC WEEDS.

H. H ALLAN, Plant Research Station, Palmerston North.

10. Mexican Marigold (*Tagetes minutus*).

THIS potentially serious weed has recently been observed by Mr. M. Hodgkins in waste places about Auckland, and has also been noted near Palmerston North. It belongs to a genus of composites containing about twenty species indigenous to the sub-tropical and tropical parts of the Americas, several of which have become naturalized in other parts of the world, though none appears to have become of moment in the United States. From the wild plants have also been developed certain favourite garden plants curiously misnamed " French " and " African " marigolds.

T. minutus has given trouble both in South Africa and in Australia, in the latter country being known as " stinking Roger." Bailey (" Weeds and Suspected Poisonous Plants of Queensland," 1906) says it " has become one of the worst of our cultivation weeds." In Europe it has established itself in various parts of Germany and in Switzerland, its entry into the latter country being traced to refuse from Australian wool. Lansdell (" Weeds of South Africa," 1925) says, " This weed was probably introduced into South Africa during the Anglo-Boer War, and was first reported from the Charlestown district, Natal. It is now widely distributed in the Union and Rhodesia." She speaks of the rapidity of its spread as " almost incredible," and remarks that it has "a wonderful adaptation to various climatic conditions, and it passes through several life cycles in one season." It is now proclaimed as a noxious weed in most parts of the Union. Lansdell's recommendations for control are—"All plants should be pulled up and burnt. In cultivated grounds tillage should be continued late in the season in order to prevent the development of seed from late-blooming flowers." This would appear a tremendous piece of work for South Africa, but

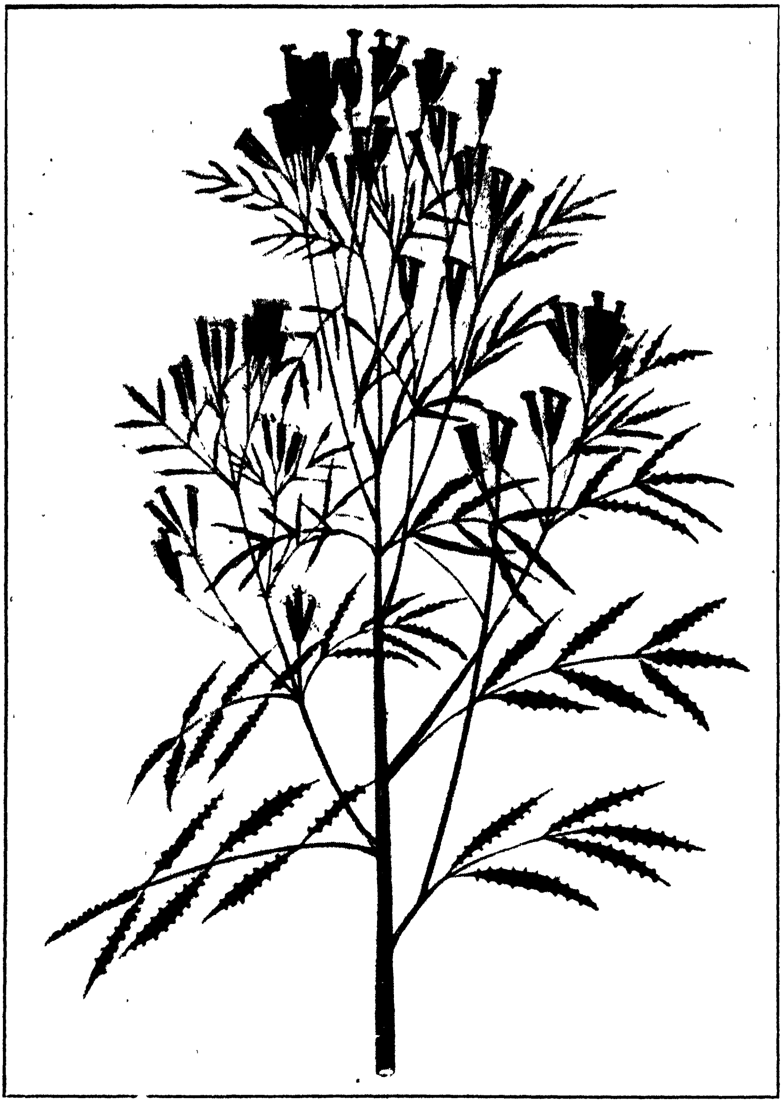

FIG. 1. MEXICAN MARIGOLD (*Tagetes minutus*).

(After K. A. Lansdell in "Weeds of South Africa." Government Printer, Pretoria.)

is a practicable proposition for New Zealand if attended to at once. Certainly the specimens I have seen testify to the plant's powers of luxuriant growth and heavy production of seed, at least in the warmer parts of the country, and it is obvious that neglect for a very few seasons would enable it to become thoroughly established

T. minutus (Mexican Marigold), (Fig 1) : An erect, much-branched annual, reaching anything from 3 ft to 9 ft high, with smooth, tough stems. The leaves are rather " fern-like " with about three pairs of leaflets and a terminal one. The leaflets are about 2 in to 3 in. long, narrow, lance-shaped, and strongly toothed The flower-heads are narrow tubes, about ½ in long, produced in great masses at the tips of the branches There are six to twelve flowers to the head, the outer with small yellowish rays, the inner tubular The fruits are narrow, about ¼ in. long, tapering to the base, black, but covered with appressed brownish hairs, and furnished at the tips with six whitish chaffy scales, of which one is much longer than the rest The whole plant when bruised has a distinct " marigold " odour

11. Yellow Weed (*Galinsoga parviflora*).

The few species of the genus of composites to which this belongs range from Mexico to the Argentine, the present species having its headquarters in Peru It is now very widely spread, being found throughout the Americas, over the greater part of Europe, in Africa and eastern Asia, and in Australia The European occurrences are considered to be derived from its early cultivation in the Paris Botanical Garden, where is was introduced in 1794 and whence it was distributed to other botanical institutions Hegi, in his Illustrated Flora of Europe, gives a detailed account of its escapes from cultivation and its widespread establishment In England the plant is particularly common about Kew, being first grown at the Kew Gardens in 1796 It appeared in Australia as early as 1873, and is now widely spread, though apparently not especially common in any locality

In all countries it appears to favour good soil, and is mainly a garden or waste-place weed controllable by the usual treatment for annuals. Seed-production is considerable, and if seeds become buried at all deeply they remain dormant and viable for a number of years The plants are rather frost-tender, but in very warm areas may be bearing flowers six weeks after germination.

The plant was first noted in New Zealand by Kirk in 1892 on a heap of ballast deposited by a ship from Buenos Ayres It appears to have died out, as no further record of it has been made about Wellington. In 1935 I noted a number of plants on reclaimed land at Stanley Bay, near Auckland, and subsequently several gardens were found to contain it. As a weed it will have much the same place as the groundsel, where frost is not severe.

Galinsoga parviflora (Yellow Weed), (Fig. 2) : An erect annual, varying greatly in stature according to soil conditions, when well developed of a bushy habit, 18 in high or more. The stems are six-angled in the lower parts, usually with a three-fid arrangement of the branchlets. The leaves are in pairs, thin, ovate, and tapering to the tips, more or less bluntly toothed on the margins, about 1½ in.

to 2 in. long. The flower-heads are small, about ¼ in. across, and usually occurring in groups of about three on slender stalks. The outer floret has small white rays and the inner are tubular and yellow.

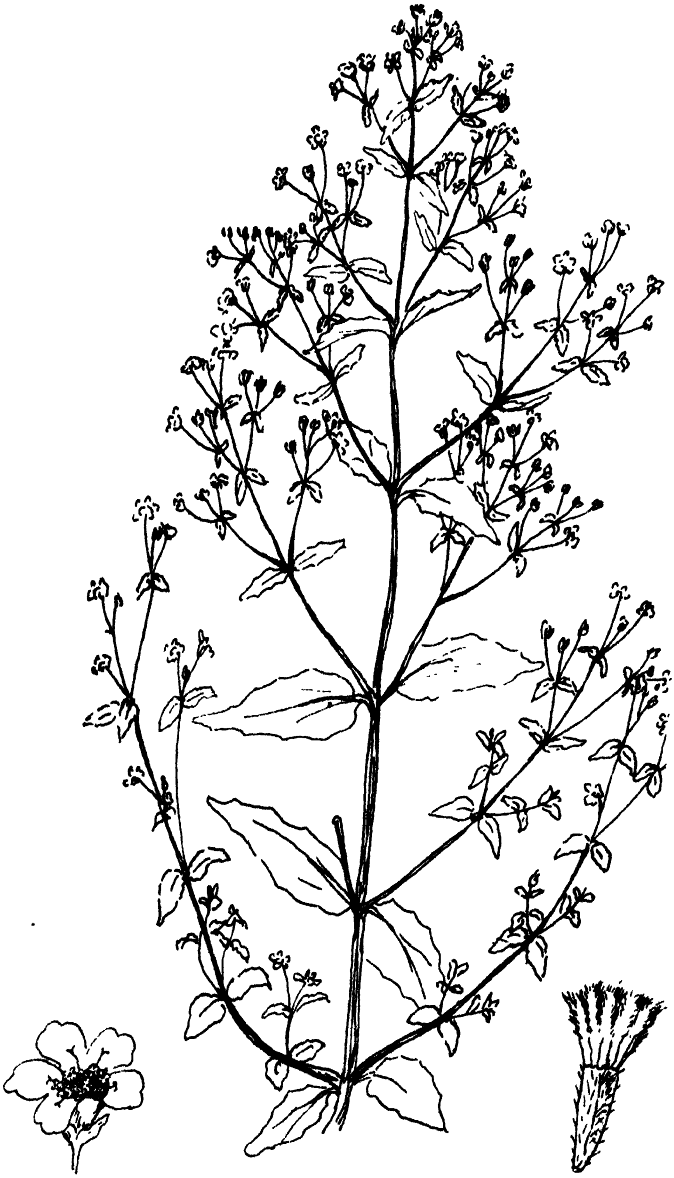

FIG. 2. YELLOW WEED (*Galinsoga parviflora*).

The fruits are small, four-sided, dark-brown, with a covering of white hairs, and surmounted by thin, flat scales with comb-like fine teeth on the margins.

TOBACCO-MOSAIC.

ITS APPEARANCE, CAUSE, AND CONTROL.

E. E CHAMBERLAIN, Plant Diseases Division, Plant Research Bureau, Department of Scientific and Industrial Research

AT some stage in the history of most of the main tobacco-growing regions of the world tobacco-mosaic has become a serious problem to the grower. That the disease is now of minor importance in many of these regions shows that it may be controlled when adequate precautions are taken.

In New Zealand it is only within the last four or five years that tobacco-mosaic has become a major problem. As yet, there has been no organized attempt to control it Provided strict precautions are taken, however, there is no reason why the disease should not be as effectually controlled here as in other countries. In this paper, based on experimental results published elsewhere (Chamberlain, 1937*), are indicated measures necessary for its prevention.

APPEARANCE ON THE PLANT.

The most obvious symptom of tobacco-mosaic is a mosaic pattern of light- and dark-green areas on the leaves (Fig. 1). The design of this pattern is not constant (Figs 1 and 3), but the dark-green areas usually occur along the veins (Fig. 1) A blistered appearance of the leaves sometimes results from more rapid growth of the darker green tissue (Figs 2 and 4) Leaf-spotting also frequently develops on infected plants (Fig. 5), this type of injury being most prevalent on Burley varieties (Fig 6)

Plants which become infected early in the season are usually much stunted (Figs. 7 and 8), while those infected later are not so much reduced in size In the case of a severe attack, resulting from an early infection, the leaves are narrow, puckered, thin in texture, and often spotted, and are valueless for curing purposes (Figs. 2 and 6).

When tobacco-mosaic attacks a plant late in the season symptoms show only on the new growth Thus if a plant becomes infected during topping, mottling usually develops only in the laterals

·On seedling plants the symptoms are not so conspicuous, consisting of a few dark-green raised areas on two or three leaves (Fig. 4). Such plants are usually smaller than healthy seedlings, and, in the seedling-beds, are often hidden by the leaves of adjacent healthy plants.

Symptoms do not develop immediately after Infection.—The mosaic mottling of the leaves does not appear until about two to four weeks after infection has taken place. The time taken for symptoms to show depends upon the rate of growth of the plants, being less than two weeks if they are growing vigorously and greater than four weeks if they are growing slowly.

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* Chamberlain, E E (1937) · *N Z Jour of Sci and Tech.*, Vol. XIX, No. 4, September, 1937.

CAUSE OF TOBACCO-MOSAIC.

Tobacco-mosaic is caused by one of a well-defined group of diseases known as plant viruses. The word "virus" is used to describe a large group of diseases some of which attack man, some animals, and other plants. A well-known virus disease of man is "infantile paralysis," and one of the best-known plant viruses is "tobacco-mosaic."

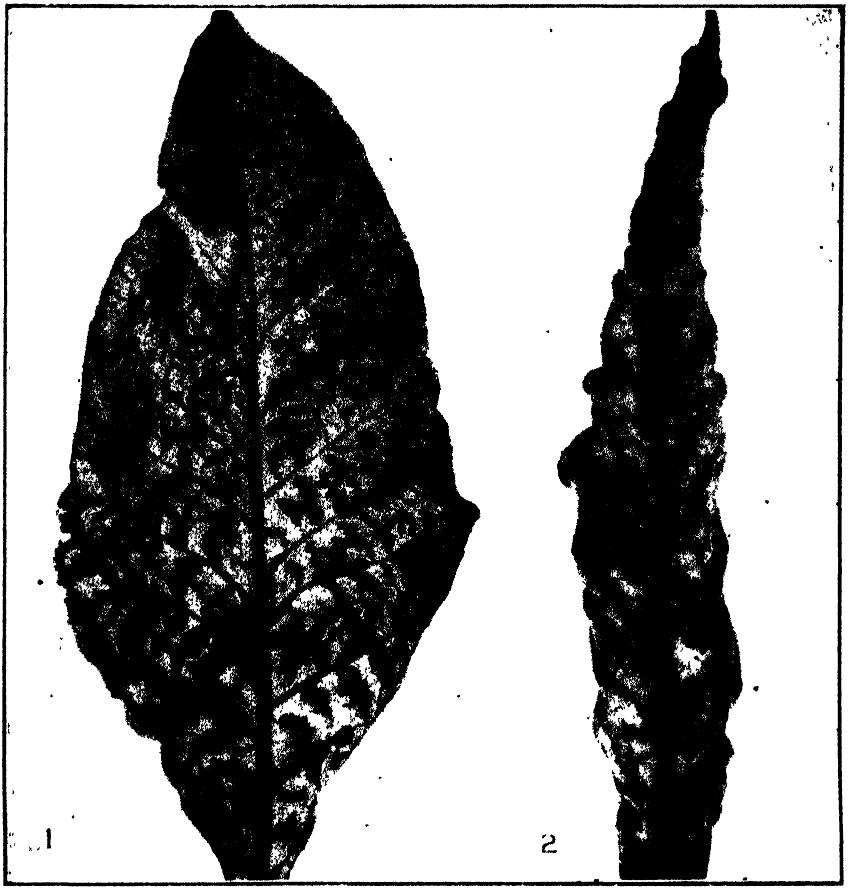

FIG. 1. MOSAIC MOTTLING OF TOBACCO-LEAF CAUSED BY TOBACCO-MOSAIC.

FIG. 2. MOSAIC-INFECTED TOBACCO-LEAF.
Showing narrowing and blister type of mosaic mottling.

[Photos by H. Drake.

These two diseases show general similarities: both are spread by contact and are caused by minute organisms. They are dissimilar in that a person may recover from an attack of infantile paralysis, but a tobacco-plant never recovers from an attack of tobacco-mosaic.

Plant viruses are usually spread by insects or by rubbing the juice from a diseased plant over the leaves or stem of a healthy plant. The tobacco-mosaic present in New Zealand is the same as that which occurs in other countries.

Extent to which Tobacco-mosaic occurs in New Zealand.—It is only five years ago that tobacco-mosaic first began to be a serious problem to growers in the Nelson District. Since then it has increased to such an extent that, to-day, it is the most important factor in the economic production of tobacco-leaf.

An inspection of crops throughout the district has shown that the amount of tobacco-mosaic has steadily increased during the past four seasons. The estimated average percentage infection in 1933 was less than 10 per cent., while during the past season it appeared to be well over 25 per cent. The disease also occurs in the Auckland Province, but to a much lesser extent.

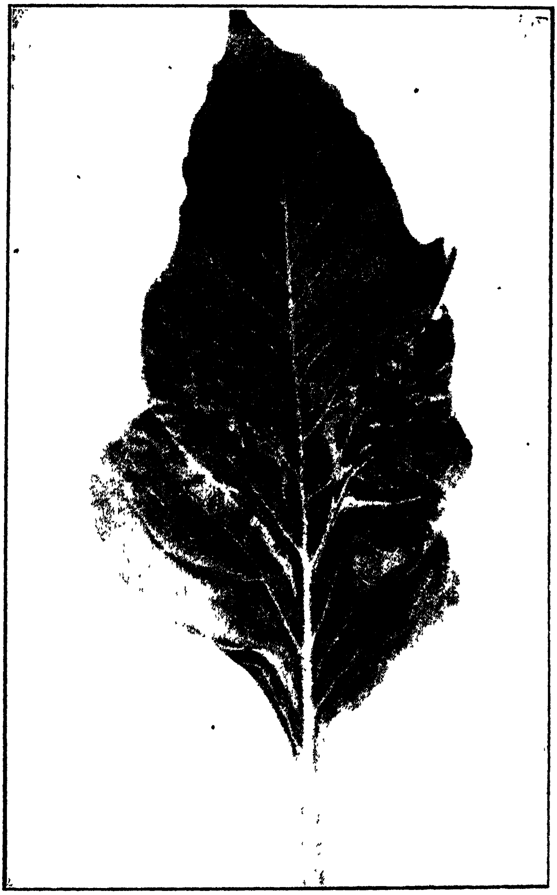

FIG. 3. TOBACCO-MOSAIC ON TOBACCO-LEAF.

Showing symptoms in which the mosaic pattern does not follow the veins.

[Photo by H. Drake.

Effect on Yield and Quality of Leaf.—In other countries tobacco-mosaic causes a reduction in crop-yield, and the leaf from plants infected early in the season is often valueless on account of its small size, thinness, poor colour, and spotting. Late infection up to the topping stage causes a slight reduction in yield and a lowering in leaf-quality.

The same is true of tobacco-mosaic in New Zealand, leaf-spotting being in particular a destructive feature of the disease in this country. In one crop of Burley tobacco, examined in 1933, leaf-spotting following mosaic was so severe that over 20 per cent. of the crop was left unharvested.

Trials in experimental plots at Palmerston North have shown that infection of plants shortly after they have been set out in the field caused a reduction in yield of 44 per cent. in a Virginian variety and 78 per cent. in a Burley variety. Leaf from these plants was quite useless for curing purposes (Fig. 6). Infection later in the season caused a reduction of 24 per cent. in the Virginian and 25 per cent. in the Burley variety. The leaf was of poor quality, but some of it was of a saleable grade (Fig. 6).

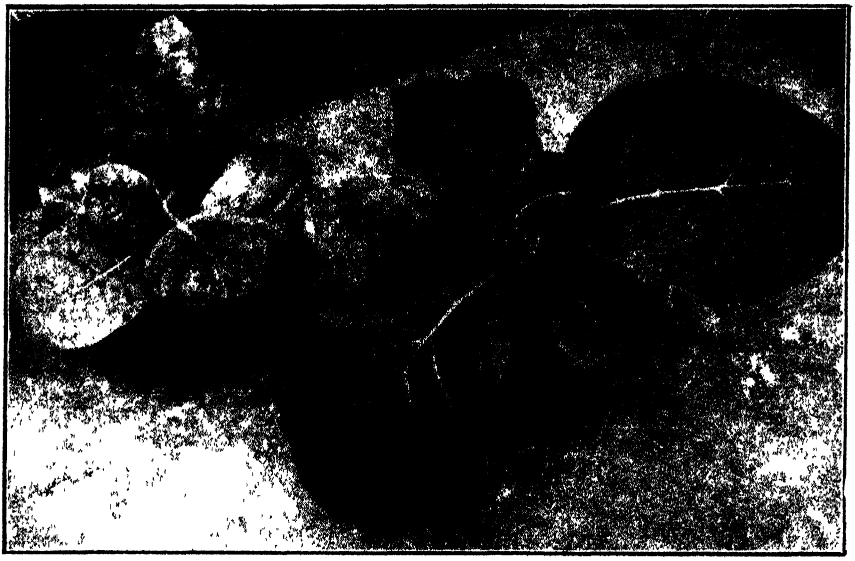

FIG. 4. TOBACCO-MOSAIC ON SEEDLING TOBACCO-PLANT

Showing blister-like dark-green areas. Healthy plant on right

[Photo by H Drake

TOBACCO-MOSAIC ALSO OCCURS ON OTHER PLANTS.

Many plants are attacked by tobacco-mosaic, the most important of these under New Zealand conditions being tomato, black nightshade, Cape gooseberry, Turkestan tobacco, egg-plant, and chilli. Of these, tomato and black nightshade* are the only ones likely to play a part in the spread of mosaic to tobacco crops. The symptoms on these plants are similar: a light- and dark-green mosaic pattern on the leaves and a slight stunting of the plant. Leaf markings are less distinct than they are on tobacco and are sometimes difficult to distinguish. On tomatoes the leaves are sometimes narrowed and distorted.

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* Black nightshade is a common weed of gardens and cultivated land. It is often erroneously called "deadly nightshade."

Increase of the Virus in Diseased Plants.

Although only a very small quantity of the virus is necessary to bring about infection of a healthy plant, it increases rapidly after infection has taken place. Thus a well-grown healthy plant may become infected if touched with a finger on which a small quantity of the mosaic virus is present. Three weeks later this plant would yield sufficient virus to infect every tobacco-plant grown in New Zealand.

It has been pointed out that the symptoms of mosaic show only in new growth, and that a plant infected late in the season may show mottling only in the laterals. In such plants the concentration of the virus is as high in the older unmottled leaves as in young leaves showing mosaic symptoms. Thus a plant which has shown symptoms in the laterals only, will, after lateraling, appear healthy and yet be a source from which the disease may be readily spread.

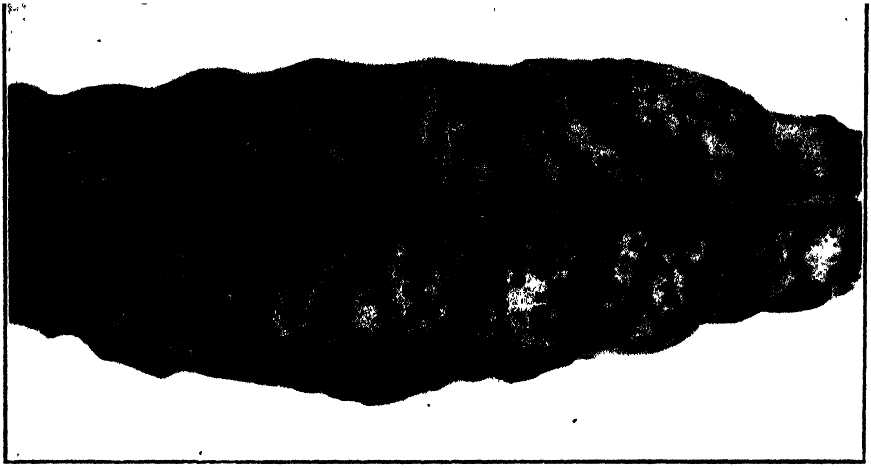

FIG. 5. LEAF-SPOTTING CAUSED BY TOBACCO-MOSAIC ON A LEAF FROM A PLANT OF THE "BURLEY" TYPE.

[Photo by H. Drake.

In America it has been found that the virus is still active in the sap from diseased plants after five years, and that it may persist in the dried leaf for over thirty years. The evidence available shows that the disease may persist for several years under New Zealand conditions.

Occurrence in Smoking Tobacco.

Tobacco-mosaic is not destroyed by the normal curing and manufacturing processes, and may be present, therefore, in prepared tobaccos. Overseas it has been shown that the disease is carried in many brands, and in some places smoking and chewing tobaccos are considered to be mainly responsible for the introduction of mosaic into the crops.

Experiments carried out at Palmerston North have shown that of nine samples of home-cured tobacco and sixteen samples, including nine brands, of manufactured tobacco, all carried mosaic infection. Home-cured tobacco carries the disease more readily than manufactured tobaccos. In some localities in America control of mosaic has been secured, in conjunction with other necessary precautions, by issuing to workmen tobacco which has been treated by heat to destroy the virus.

Heat Treatment.

It has been found both in New Zealand and in other countries that, when heated for ten minutes, 195° F is the lowest temperature at which the mosaic virus can be killed. Therefore, in order to destroy the disease it is necessary to maintain tobacco at a temperature in excess of this for ten minutes.

Heat does not penetrate readily into tobacco, and experiments have shown that a sufficiently high temperature cannot be secured by heating it in a tin either above or partly submerged in boiling water. A satisfactory way of destroying mosaic is to heat the tobacco in steam under pressure. Tobacco in 2 oz. sealed tins may be successfully treated in steam at 10 lb. pressure for fifteen minutes. This method necessitates special equipment, as an autoclave is required to obtain the pressure

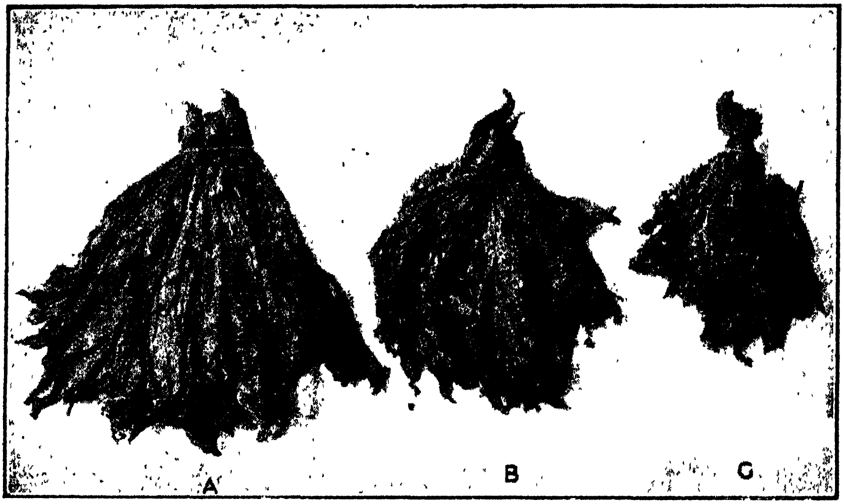

FIG. 6. EFFECT OF TOBACCO-MOSAIC ON THE YIELD AND QUALITY OF LEAF

Each bundle is the product of six plants A "Burley" variety

A Leaf from healthy plants
B Leaf from plants inoculated with tobacco-mosaic on 17th December, 1934
C Leaf from plants inoculated with tobacco-mosaic on 5th December, 1934

(Photo by H. Drake.

Steam treatment under pressure darkens the colour of the tobacco and alters the flavour slightly.

Infectious Nature of the Disease.

Tobacco-mosaic is the most infectious plant virus disease known. The sap from diseased plants may be diluted to 1 part in 1,000,000 parts water and still bring about infection when rubbed on the leaves of healthy plants.

Infection can take place only through wounds, the disease gaining entrance most readily through very small injuries such as are caused by the breaking of leaf-hairs, which occurs whenever a leaf is touched. Thus, if the mosaic virus is present on the fingers, the mere touching of healthy plants is sufficient to infect them with the disease.

The ease with which infection may be brought about has been clearly shown by experiments carried out at Palmerston North. Sap from mosaic-infected plants was rubbed on the leaves of over 750 healthy tobacco-plants growing in the field, and all developed the disease.

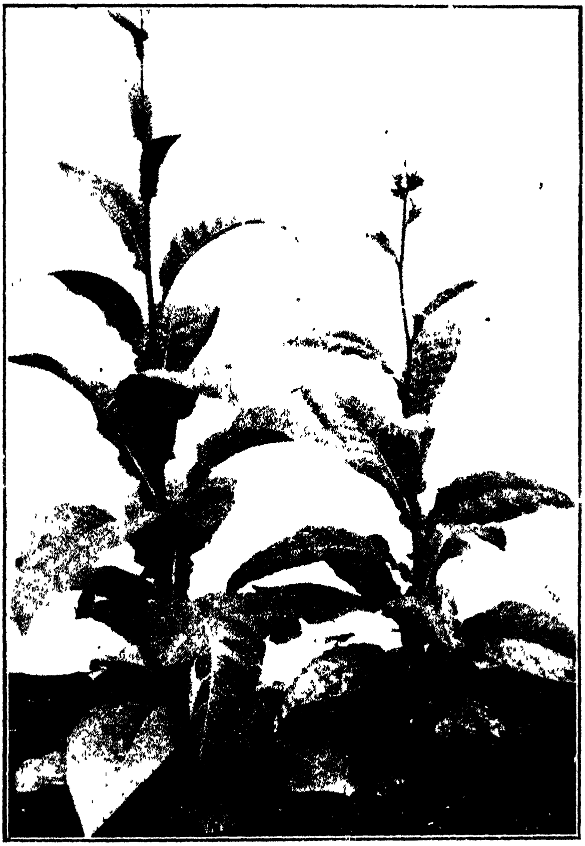

FIG. 7. COMPARISON OF HEALTHY AND MOSAIC-INFECTED PLANTS.
Note stunting of plant and narrowing of leaves.

Photo by H. Drake.

Spread of Tobacco-mosaic by Handling.

In the field handling of the plants with contaminated fingers is the main method by which the disease is spread. Plants are handled a number of times during the season, affording many opportunities for the introduction and spread of the disease. Observations indicate that most of the infection takes place at the various times of handling—that is, at (1) pricking-out of seedlings into the beds, (2) pulling of plants from the beds and transplanting to the field, (3) topping, and (4) lateraling.

The hands may become contaminated with the virus from (1) infected tobacco-plants already present in the crop, (2) smoking tobacco, (3) other infected plants such as tomatoes or black nightshade, (4) infected leaf or other plant-remains left over from the previous season.

Experiments were carried out to determine the extent to which the disease was spread during lateraling. Two workmen, after lateraling a number of infected plants, each lateraled one row of thirty-five healthy plants When the crop was inspected three weeks later 83 per cent. of these plants had developed mosaic.

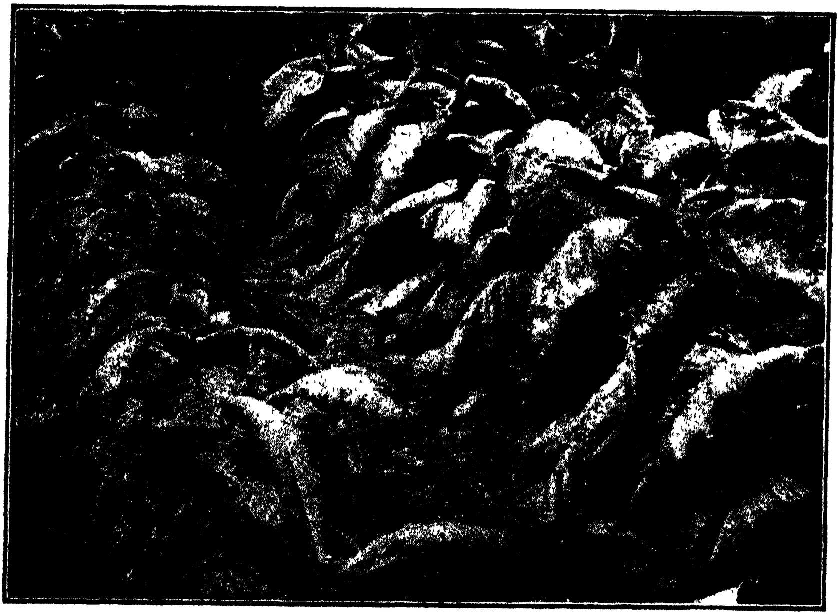

FIG. 8. TOBACCO-PLANTS INFECTED WITH TOBACCO-MOSAIC

Healthy plants on right. Portion of the 1934-35 yield trials. Variety " Warne "

[*Photo by H. Drake.*

Rapid Spread towards the End of the Season.

The amount of infection in a crop increases rapidly from the topping stage until the end of the season. Thus a crop which is showing 5 per cent. noticeable infection before topping may be 100 per cent. infected by harvest-time. Although the bulk of the leaf from such a crop may be normal in appearance and of good quality, it nevertheless carries mosaic infection.

The virus of tobacco-mosaic may be removed from the hands by thorough washing. It is not easily removed in this way, however, and to be effective the washing must be very thorough. It is advisable to use warm water, plenty of soap, and a nail-brush. Then, to remove all traces of the virus, the hands should be rinsed in running water or a change of water. Care should be taken not to recontaminate the hands from towels carrying infection.

Tobacco-mosaic may remain Alive in the Soil.

The mosaic virus may remain alive in the soil during the winter and bring about infection of healthy plants in the spring. In rare instances it may survive two winters The disease usually persists in the roots and stalks from infected plants of the previous season, but it may also occur in the soil in the free state. As a rule the amount of infection which takes place from the soil is small although occasionally it may be as high as 25 per cent.

Experiments carried out at Palmerston North have shown that where tobacco-mosaic has been present in a seedling-bed it may remain in the soil and infect the seedlings in the following season. In an instance where seedlings were pricked out into such a bed the plants, although they did not show the disease while in the seedling-bed, showed over 11 per cent infection after they had been transplanted to the field.

It has also been found that where mosaic-infected plants growing in the field are removed and replaced with healthy plants a high percentage of the replants develop the disease. Thus, of 129 healthy plants replacing diseased ones, 72 per cent became infected

Although many virus diseases are spread by insects, the results of investigations here and in other countries indicates that tobacco-mosaic is rarely if ever carried in this way

In other countries it is generally held that tobacco-mosaic is not carried in the seed of tobacco An investigator in Russia has claimed however, that it may be carried in the dust which is often mixed with the seed Preliminary trials in New Zealand suggest that the disease may sometimes be carried to a small extent either in or with the seed Further trials are necessary before this question can be considered settled

It has been shown in experiments at Palmerston North that tobacco-mosaic is carried in a small percentage of seed harvested from infected plants of tomatoes and black nightshade.

MEASURES FOR THE CONTROL OF TOBACCO-MOSAIC.

In outlining measures for its control it is stressed that tobacco-mosaic is very infectious and that it is essential to take the very greatest precautions to prevent its spread. The disease may be introduced in a number of ways, and field observations in the Motueka District indicate that the method of introduction varies from crop to crop. Control measures which are successful in one crop may, therefore, fail in another, so it becomes necessary to carry out all measures with equal thoroughness.

Control of tobacco-mosaic presents two problems: Prevention of introduction of the disease to the crop and prevention of spread after the disease has appeared.

A. Prevention of the Introduction of Tobacco-mosaic to the Crop.

There are three ways by which the disease may be introduced: (1) With the seed; (2) through the soil; and (3) by human agency.

(1) *With the Seed.*—At present no measures are taken to ensure that the seed used on New Zealand is taken from healthy plants. This will become a necessary precaution if it is shown ultimately that tobacco-mosaic is carried with the seed.

(2) *Through the Soil.*—The disease is frequently introduced into the crop through the soil. Plants may become infected by means of contaminated soil in (*a*) seed-boxes, (*b*) seedling-beds, and (*c*) field.

(*a*) Seed-boxes : Soil used in seed-boxes should be steam-disinfected. When steam-disinfected soil is not available fresh soil should be obtained from land which has not been in tobacco or tomatoes for at least two years.

(*b*) Seedling-beds : Beds in which mosaic has appeared should not be used the next season unless the soil is replaced or disinfected with steam. New beds should be prepared on land which has not been in tobacco or tomatoes for at least two years.

If plants in a seedling-bed remain free from mosaic, the bed may be used a second season. All tobacco-plants should be removed as soon as possible after field planting has been completed, and the bed kept free from weeds until it is prepared for the new season

(*c*) Field : The disease is carried over in the soil mainly in the roots and stems of the previous season's crop. The virus may also be leached out of such plant-remains and persist in the soil in the free state. Therefore all roots and stems should be removed from the field as soon as possible after the completion of harvesting, and, after drying in the sun, should be burnt.

(3) *By Human Agency* A great deal of infection with tobacco-mosaic takes place through the handling of plants with contaminated fingers. The many handlings to which the plants are subjected during the growing-season affords excellent opportunities for the introduction of the disease. The fingers of workmen may become contaminated by handling—(*a*) home-cured or manufacture tobaccos, (*b*) rubbish from previous season's crop ; (*c*) cured leaf (often discard) left in sheds from previous season , or (*d*) other infected hosts.

(*a*) Home-cured or Manufactured Tobaccos : Since practically all tobacco carries infection, smokers working with plants should smoke only sterilized tobacco.* This precaution should be taken from the commencement of pricking-out of seedlings into the beds until harvesting, and both at work and at home

(*b*) Rubbish from previous Season's Crop : Owing to the high percentage of infection at the end of the season all tobacco-plant remains must be regarded as infected and capable of carrying the disease over to the next season. Therefore, after drying of the leaf is completed, all tobacco refuse should be collected from in and around the kilns and sheds and destroyed by burning.

(*c*) Cured Leaf : All saleable leaf should be disposed of at as early a date as possible. Unsold leaf should be stored and not left lying in the sheds. All discard leaf should be burnt as soon as grading is completed.

(*d*) Other Infected Hosts : Mosaic sometimes spreads to tobacco from infected tomato or black-nightshade plants.

If tomatoes are grown on the farm every care should be taken to see that they do not become infected. Thus all seed sown should be from healthy plants and the same precautions taken as when dealing with tobacco. As the symptoms on tomatoes are sometimes very slight and may not be noticed, the hands should be thoroughly washed after working with this crop.

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* Until such time as arrangements can be made to have tobacco sterilized in the Nelson District, growers may have their tobacco treated free of charge by forwarding it to the Plant Diseases Division, Box 16, Palmerston North Factory-made cigarettes cannot be treated.

On account of the inconspicuous symptoms displayed, black nightshade may act as an unsuspected source of infection Mosaic is more likely to be present on this plant because of the ability of the virus to carry over in the seed Special care should be paid to the eradication of this weed in the seedling-beds and surroundings If plants are pulled the hands should be washed before again working with tobacco

B. Prevention of Spread after Infection has taken Place

Once tobacco-mosaic has been introduced it may spread rapidly through the crop. Spread takes place through the soil and by workmen.

(1) *Through the Soil* Although tobacco-mosaic is not known to pass from diseased to healthy plants directly through the soil, it does spread from infected plants to healthy replants It is suggested, therefore, that when making replants the infected plant be removed complete with a large shovel-full of surrounding soil Before replanting the hole should be filled with soil from between the rows

(2) *By Workmen.* This is the commonest method of spread of tobacco-mosaic Unless a great deal of care is taken each operation which entails handling of the plants may bring about a marked increase in the amount of the disease

Before pulling plants for setting out in the field the seedling-beds should be carefully inspected If only a few infected plants are found, these, together with a group of surrounding plants should be removed and destroyed Where there are many infected plants in a bed it is inadvisable to set out any plants from it The person doing the pulling should watch carefully for diseased plants, and when one is discovered it and a group of healthy plants surrounding it should be left unpulled. If an infected plant is accidentally pulled the person who has handled it should wash his hands before taking out any more healthy plants.

After plants have become established in the field they should be carefully inspected for mosaic Plants showing infection at this stage do not produce any saleable leaf, and furthermore act as a potent source of infection for the rest of the crop They should be removed and destroyed and their places filled with healthy replants. Several inspections should be made at seven- to ten-day intervals.

The disease may be spread on implements during cultivation, so as much care as possible should be taken to prevent them from rubbing against the plants.

If tobacco-mosaic is present in a crop a great deal of spread is liable to take place during topping and lateraling operations. To keep the amount of spread down to a minimum, one person should go through the crop ahead of the rest of the workmen and top or lateral all infected plants. This should be practised even late in the season when it is considered that mosaic will no longer affect the yield or quality of the crop, for, by keeping down the amount of infection, there will be less disease to carry through to the next season.

During all stages of growth of the crop workmen should be careful to thoroughly wash their hands after handling diseased plants. To be effective washing must be very thorough, it being advisable to use warm water, a nail-brush, and plenty of soap. After washing, the hands should be rinsed in running water or a change of water.

SUMMARY OF CONTROL MEASURES.

(1) Use steam-disinfected soil in the seed-boxes.

(2) Do not use a seedling-bed for a second season if tobacco-mosaic has been found therein.

(3) Establish new beds on ground which has not been in tobacco or tomatoes for at least two years.

(4) Keep the beds and surroundings free from weeds and stray tobacco-plants.

(5) Inspect seedling-beds prior to pulling plants for field planting, and remove and destroy any infected plants. If much mosaic is present in a bed do not set out any plants from it.

(6) Workers handling plants should smoke only sterilized tobacco or be non-smokers.

(7) Avoid contamination from other hosts. To this end keep tomatoes free from mosaic and eradicate black-nightshade plants.

(8) Remove and destroy diseased tobacco-plants as soon as they are noticed in the field.

(9) Remove the soil surrounding the infected plants when replacing them and fill in with clean soil before replanting.

(10) Avoid handling infected plants when working with healthy ones.

(11) Thoroughly wash the hands with soap and water to remove contamination whenever infected plants have been handled.

(12) Plough out roots and remove them from the field, together with stems and old leaves, and destroy by burning.

(13) Destroy all discard leaf as soon as possible after curing and grading is completed.

(14) Remove all tobacco from the farm at as early a date as possible.

In a strain trial at Palmerston the influence of clover on the relative value of cocksfoot and rye-grass is very marked. Throughout the major portion of the trial, which was sown with a mixture of grasses and clovers, there is a good healthy mixed sward, with rye-grass the dominant and best producing grass. Cocksfoot is present, but compared with the rye-grass is of much less value. On the "no clover" plot rye-grass is also dominant as regards ground cover, but cocksfoot is much the better producer and in the circumstances is the better grass. All plots have been liberally top-dressed with lime and super. This top-dressing appears to be thrown away as far as the "no clover" plot is concerned at present.—*Fields Division.*

SEASONAL NOTES.

THE FARM.

Special Feed Provision of Seasonal Importance.

A SEASONAL matter of great moment is consideration of the steps to be taken during the coming year in regard to the provision of special feed to supplement the pastures during those periods when the feed directly available from pastures is likely to be below the economic requirements of the number of stock that should be carried to bring about advantageous consumption of the main supply of feed, which is that harvested directly by the animals themselves from the pastures.

In considering this matter the dairy-farmer is confronted by two major facts. Firstly, even the average dairy cow calls for a higher standard of feeding than do other classes of cattle or sheep, while the good dairy cow is particularly exacting and exceptional in its requirements. One reason for this emerges clearly from a comparison of the requirements of the breeding-ewe and the dairy cow. Like the dairy cow the breeding-ewe calls for liberal supplies of high-quality milk-producing feed in preparation for and during the period of its useful production of milk. The vital difference between the cow and the ewe is that the milk-production of the cow should continue at a relatively high level for several months after that of the ewe, and this in the latter part of the summer and autumn, when the pastures frequently do not readily or naturally provide feed that is fully suitable for a high level of milk-production. Another reason for the comparatively high standard of feeding required by the dairy cow lies in its high standard of production. An indication of this is obtained by comparing the steer putting on the satisfactory daily gain of 2 lb. live weight and the cow giving the moderate yield of 3 gallons of milk daily; the former elaborates from its food 1½ lb. of dry matter daily, the latter 3¾ lb. daily—two and a half times as much. It is notorious that the good dairy cow frequently is fed substantially below its economic requirements. The facts just considered assist in explaining why this is so. The modern good dairy cow is a relatively recent development in the world's farming. Hence, in the evolution of traditional live-stock feeding practice the needs of the modern dairy cow were not taken into account; indeed, they could not be taken into account, for the counterpart of the modern dairy cow did not exist. Hence it follows that the experience which taught how to feed well either cattle—as just cattle—or sheep is far from enlightening as to the needs of the dairy cow. Better feeding of good dairy cows may be expected to arise from fuller and wider realization of their special needs.

The second fact of importance in regard to the dairy-farmers' provision of feed is that the well-managed sow is in an important respect more exacting than the good cow in its requirements of feed. This originates in the fact that in the feed-supply needed by a sow which rears two litters annually there are two peak periods, and while one of these may coincide with the period when cheap supplies of pig-feed, such as dairy by-products, are most freely available, both of them of necessity cannot do so. Further, the sow, because of physiological differences between the sow and the cow, should receive feed of even better quality, in respect to high digestibility and low content of fibre, than that given the dairy cow. Summed up, in the cow and the sow the dairy-farmer handles stock which require a feed-supply (*a*) that should be of comparatively generous quantity and good quality, and (*b*) that should be maintained for an exceptionally large part of the whole year. These two features of the dairying feed-supply should be given close attention in planning the year's production of feed. In this connection a point of basic importance is that the variations from month to month in the feed requirements of stock do not correspond with the variations in the direct yield of feed from month to month by typical grassland

There is evidence that many sheep-farmers profitably could make greater provision of special supplementary feed than they are accustomed to make. It is well known that lambing percentages are affected materially by the condition of the ewes at service It is known that superior results are obtained when " flushing " of the ewes is carried out—*i e*, when the ewes are in rapidly improving condition when they are served. In some districts favoured by timely rains the growth of grassland allows of flushing to occur almost naturally and with a minimum of effort on the part of the farmer to bring it about But in districts with a climate similar to that of much of the Central Hawke's Bay or of Canterbury flushing usually calls for the use of feed specially provided for the purpose. Recent investigations in Hawke's Bay point to the possiblity of increasing the lambing percentages at times by 6 per cent to 10 per cent by suitable flushing. In limited experience in the South Island, under irrigation which facilitates the provision of flushing-feed, even greater increases in lambing percentages have been credited to flushing

Relative to the provision of special supplementary feed, many sheep-farmers probably with advantage could give more attention to the fact that lambs that are kept thriving are seldom troubled seriously with internal parasites. Since at least the beginning of this century, veterinarians and others have pointed to the value of good feeding in lessening the ravages of such parasites The position recently has been stated strikingly by Dr Fraser, of Rowett Institute, Aberdeen, thus: " My considered advice is to look after the sheep, and the sheep will look after the worms." While this is not advanced as a full statement of the position, in so far as it relates to proper feeding, it is in accord with the advice of New Zealand authorities

The winter feeding of breeding-ewes often could be improved with profit A direct step towards such improvement would be additional provision of special feed to supplement the pastures There is evidence that improved winter feeding of ewes at times would lessen troubles and losses at lambing, and that it would increase the number and the weight of the lambs fattened " off the mothers."

The foregoing remarks are designed to indicate the practical importance to both the sheep-farmer and the dairy-farmer of the proper provision of special supplementary feed with the object of making the supply correspond with the requirements of feed from season to season throughout the year. On all farms, except those on which arable crops are dominant, the question of special supplementary feed is indeed of prime importance at this time of the year. Measures which can be made to assist greatly in meeting the position—ensilage and special cropping—are ones for which preparation usually should be in progress about this time

Ensilage.

The two main tasks relative to ensilage that at this stage call for attention are—

(1) *The Closing of Suitable Pastures.*—There should be no delay in the closing of fields for silage. A common error is the making of silage at a later date than is desirable. One of the advantages of ensilage in comparison with hay-making is that silage usually may be removed early enough to allow of a substantial leafy aftermath before the customary dry summer period during which such an aftermath frequently is especially useful. As a rule, it is profitable to top-dress fields with superphosphate just before closing them for hay or silage if they have not been top-dressed during the previous year.

(2) *The Construction of Pits or Trenches if these are still to be farmed.*—Suitable sites are to be found on a great many farms for pits or trenches, which usually can be made quite inexpensively Hence, as a rule, it is not difficult to provide sufficient pits or trenches located at different points on the farm in such a way that the necessity for using the same pastures frequently for ensilage may readily be avoided If convenient terraces on which pits can suitably be placed are not available, then trenches which quite satisfactorily can be located on level paddocks may be employed In trenches, which are simply shallow pits, silage has been saved with the wastage so slight as to be immaterial. When the pit or trench method of ensilage can be adopted it usually should be followed, as it not only minimizes wastage of crop material, but also lessens the amount of labour and equipment required. Trenches have been used successfully in soils which are far from well drained—*e g*, heavy level soils in districts of 40 in to 50 in of rainfall annually and with no artificial drainage, but despite such experience it is naturally advisable to avoid as much as possible poorly drained sites for trenches, as bad drainage in the vicinity of the sites tend to hamper the carting out of the silage for feeding

The plans for the production of special feed often quite well may provide for haymaking as well as ensilage When surplus grass is being harvested during good haymaking weather, it is then good practice to turn such grass into hay instead of silage, hay is more suitable than silage for feeding in conjunction with roots, which should be used on many of the farms on which ensilage also is well worth while

Special Forage Crops.

Often the needs in respect to special supplementary feed cannot be met fully by ensilage and haymaking In sheep-farming the flushing of ewes or the feeding of hoggets possibly may be best carried out by the use of special crops In dairying the provision of sufficient highly digestible feed in the latter part of the summer is particularly important, at times the feed available directly from grassland commences to fail shortly after Christmas as a ration for reasonably productive dairy stock While it is not difficult to supplement the pastures suitably during the latter part of January and in February, it is not altogether easy always to remedy the weak position that occurs a little earlier Fresh leafy growth such as an aftermath on an ensilage field or a second growth on a lucerne area are likely to be specially useful at this period When there is no certainty of sufficient leafy feed from such sources, it generally is advisable to sow in October an area of quickly maturing soft turnips, such as Purple Top Mammoth, for use early in the New Year

In general at this time of the year it is particularly desirable to push ahead as rapidly as possible with the preparatory work for such crops as mangels, rape, chou moellier, and other kales, lucerne, and swedes. There is much evidence from the field that the thoroughness of cultivation is more frequently and more gravely a limiting factor in crop-yields than is commonly believed, that full benefit is not received from good seed and suitable fertilizers because the cultivation is the weak link in the chain of factors that constitute efficient crop-culture.

The acreage devoted to the mangel in the Dominion in 1935-36 was higher than usual, but sales of seed suggest that a decrease in acreage took place last season. Having regard to all the current circumstances the mangel actually warrants increased rather than decreased attention. Over a wide range of conditions efficient culture results consistently in yields of 50 tons or more of mangels an acre. It is of seasonal importance that success with the mangel depends upon high fertility and thorough cultivation. Hence, if land intended for mangels is not naturally rich it should be made so by the use of farm or artificial manure or both, and due attention should be given to the fact that the mangel responds profitably to abundant and thorough cultivation both before and after the sowing of seed.

Chou moellier or marrow stemmed kales and other kales have at times been sown in October with good results for the provision of feed from the middle of January or the beginning of February. Later sowings to provide feed in the following autumn and winter are usually advisable. Chou moellier continues popular among both sheep-farmers and dairy-farmers. It requires the soil conditions which suit the cabbage—*i e.*, high fertility, which it well repays It usually responds profitably to a dressing of 2 cwt. to 3 cwt. an acre of superphosphate on good land, a dressing which as a rule it is advisable to supplement with 2 cwt to 3 cwt. an acre of blood and bone on poorish land which has not been enriched by farmyard or similar material that is excellent for chou moellier. The popularity of chou moellier is due not only to its good feeding and good potential yield, but also to the three following facts : (1) Its total labour requirement is relatively small ; (2) it is highly resistant, though not immune, to club-root, and so can be grown safely where swedes would fail because of the ravages of club root ; (3) it can be fed *in situ* with the minimum of waste under wet conditions in the winter.

On free soils the carrot proves distinctly productive and useful under suitable management. Of the roots commonly grown the carrot has the greatest feeding-value per ton, and yields of over 40 tons an acre are not at all uncommon. The Guerande variety rightly appeals to many because it may be grown in such a manner that thinning is inadvisable, and, because of its habit of growth, digging is unnecessary. Ordinarily it should be grown at the rate of 1 lb. to 1½ lb. of seed an acre, in rows 18 in. to 24 in. apart, and intercultivated as much as possible, but it may be grown without intercultivation when sown at the rate of 1½ lb. of seed an acre in rows 14 in. apart. It is considered good practice, especially for sheep, to sow it on low ridges obtained by rolling after the ordinary ridger Other varieties popular because of their consistently good yields are Matchless White, Barriball, and White Belgian. Preparatory cultivation is most generally commenced between mid-August and mid-October. The seeding usually adopted is 1 lb. to 1½ lb. of seed an acre in drills 14 in. apart, but very good yields have resulted from sowing in drills 18 in. to 24 in apart A popular manurial dressing is a mixture of superphosphate and bonedust at the rate of about 4 cwt. an acre.

Preparatory cultivation for lucerne, if not already in progress, should be started without delay Though the area of lucerne in the Dominion has increased by about 50 per cent. in the past decade, lucerne could, with much profit, be grown very much more widely in both the North Island and the South Island. Much information about the establishment and the general culture of lucerne is given in Bulletin No. 155, which may be obtained free on application to any office of the Department of Agriculture. The appeal of the crop is particularly wide, as it has been used with good results in New Zealand in the feeding of sheep, cattle, pigs, poultry, and horses The history of lucerne-culture in New Zealand contains many instances of failures, which in the light of the knowledge now available could have been avoided easily—indeed, at times the practices adopted with lucerne were fitted to beget failure rather than success. Because of the later additions to our knowledge, lucerne to-day is being grown successfully over a wide range of soils and climates in New Zealand.

The Potato Crop.

In many districts the main crop of potatoes should be sown in October. Of outstanding importance is the use of " seed " healthy in all respects. The most serious form of disease is carried in the tubers. Knowledge of this form of disease is incomplete—no visible causative organism is known—and the term virus is applied to it. Several forms of virus disease are known, and an important feature common to them all is that while the symptoms can be seen readily in the foliage they cannot be seen in the tubers, and so it is impossible to tell by inspection of "seed" whether it is healthy or suffering from a virus. The official seed-certification carried out by the Department of Agriculture gives much attention to the amount of virus visible in the foliage of the parent crop at the time of field inspection, the objective being to make available lines of potato "seed" with relatively small amounts of virus infection. Hence, as a rule, the only safe course is the use of certified seed from crops where the virus incidence is known to be small. A concrete illustration of the value of certified seed is given in official data published by the Government Statistician, and based on returns supplied by farmers. The data relate to 10,000 acres—the total Dominion crop approximates 22,000 acres—grown throughout the Dominion, about one-quarter of this 10,000 acres being in certified seed, the average yield an acre from certified seed being 7·43 tons, while from uncertified seed it was 5·95 tons. Hence an increase of 25 per cent. in yield is associated with the use of certified seed.

The following varieties are of well-established merit: Aucklander Short Top (usually grown in the North Island as Sutton's Supreme), a second early which rightly is very popular, since it consistently gives satisfactory yields of good keeping and cooking quality, but it bruises rather easily in handling; Aucklander Tall Top, similar to Aucklander Short Top, except that it is later, being a main crop; Dakota, a standard main-crop variety that generally does well on medium land in Canterbury; Arran Chief, good lines of which should be popular on heavier land; King Edward, a potato of outstanding quality, which in general has not yielded satisfactorily except in Southland; Epicure, an early variety which can be recommended when certified seed is to be used.

—*R. P. Connell, Land Utilization Officer.*

THE ORCHARD.

Spraying.

No hard and fast rules can be laid down for the spraying of fruit-trees, as the programme to be followed largely depends on the climatic conditions prevailing during the season. The following general programme, giving the different periods of application and strengths of the sprays recommended, should act as a guide to growers.

The first application of spray after the trees have commenced growth, known as "foundation spray," is most important, and on no account should be omitted by growers. The first spray should be applied during the month of September, the dates varying in the different districts:—

Apples:—

(1) **Green-tip Period:** Bordeaux mixture 5–4–50; lime-sulphur 0·5 per cent. (1–30).

(2) **Open-cluster Period:** Lime-sulphur 0·2 per cent. (1–75); or lime-sulphur (1–50) plus colloidal sulphur 2–100.

(3) **Petal-fall Period:** Lime-sulphur 0·1 per cent. (1–500) plus colloidal sulphur 2–100 plus lead arsenate 1½–100 plus hydrated lime 3–100.

(4) **Ten to Twelve Days later:** Same as No. 3.

(5) **Fifteen to Eighteen Days later:** Lime-sulphur 0·083 per cent. (1–180) plus colloidal sulphur 2–100 plus lead arsenate 1½–100 plus hydrated lime 3–100.

(6) Subsequently at Fifteen to Twenty Days' Intervals till Mid-January, and later if necessary: Same as No. 5.

The dilutions given in these notes for lime-sulphur refers to a specific containing 15 per cent. of polysulphide content, calculated on the basis of weight. During January and February apply summer-oil at strength 1–100 to 1–150. Two applications at close intervals for the control of red mite, &c. These sprays should not be applied within fourteen days of sulphur sprays.

Slight variations can be made from the above programme when spraying special varieties. For instance, with Cox's Orange Pippin lime-sulphur can be dropped after the first two sprays, using colloidal sulphur at strength 2–100, reducing to 1–100 as the season advances. With Jonathan and Dunn's Favourite colloidal sulphur may be substituted for lime-sulphur according to weather conditions.

Pears.—

(1) Green-tip: Bordeaux mixture 5–4–50.
(2) Pink Period: Bordeaux mixture 3–4–50.
(3) Fruit-set Period. Bordeaux mixture 3–4–50 plus lead arsenate 1½–100.
(4) Later, at Intervals: Lime-sulphur 1–180 plus lead arsenate 1½–100.

Exception can be made with the Winter Cole, P. Barry, and Josephine varieties, the following sprays being recommended:—

(1) Green-tip: Bordeaux mixture 3–4–50.
(2) Pink Period: Lime-sulphur 1–75
(3) Fruit-set Period: Lime-sulphur 1–180 plus lead arsenate 1½–100
(4) Later, at Intervals: Same as No 3

Stone-fruits:—

(1) Bud-movement Period: Bordeaux mixture 5–4–50.
(2) Pink Period: Bordeaux mixture 3–4–50 or lime sulphur 1–100.
(3) Fruit-set Period: Lime-sulphur 1–180 plus colloidal sulphur 2–100.
(4) Intervals: Same as No. 3.

During January and February it may be advisable to apply nicotine sulphate at strength 1–800 plus 3 lb. soft soap for the control of black and green aphis, repeating the application in seven to ten days.

Cultivation and Manuring.

Ploughings, whether autumn or spring, should now be receiving attention if the best results are to be obtained. The breaking-down of the soil by disk, harrow, and cultivator does much to aerate the soil and to create a fine tilth so necessary during any dry periods that may follow during the growing-season. Cultivation round the trees is an important operation too often neglected. The thorough working of the soil at this time of the year not only makes cultivation much easier during the balance of the season, but has a great influence on the growth of the trees and the crops carried. Every effort should be made to harrow the orchard after rain to break the crust, to prevent drying out, and to promote capillarity between topsoil and subsoil so necessary for the welfare of the trees. Further delay in the application of manures may mean that the trees will not receive the benefits to be expected during the present growing-period.

Planting.

New plantings should be proceeded with as soon as the soil is in a suitable condition to receive the trees. Should the ground be cold and wet, it will be preferable to defer planting for a week or two to ensure that the young trees receive no setback at the start. All broken and bruised roots should be cut off, and the top cut back sufficiently hard to form a good framework for the future tree. The young trees should be placed on a slight mound within the hole so as to give the roots a downward inclination—roots well spaced and the soil well pressed round the roots The trees should be planted firmly. A small application of blood and bone manure mixed with the soil to be used for filling in the hole will materially help in giving the roots a good start for the coming season.

Grafting.

The time for the renovation of fruit-trees by means of grafting is now approaching; in fact, providing the season is suitable, grafting may be done in some parts towards the end of September, but, as the majority of the work is done in October, further notes on this subject will appear next month. It is necessary to see that the scions to be used in the operations are kept in a dormant condition, free from disease, and that the buds, from which the new growths will start, are in a healthy condition

—*George Stratford, Orchard Instructor, Motueka.*

Citrus Culture.

Reworking.—Most lemon and orange orchards contain a number of trees that produce fruit of an inferior type consistently year after year. Although a percentage of the fruit from such trees may be marketable, it is seldom wise to retain such trees In most cases it is best to work the trees over with buds taken from trees that consistently produce heavy crops of high-quality fruit The same recommendation applies in the case of unsuitable varieties

The standard method of propagating citrus is by budding, which is much simpler, quicker, and more economical of budwood than any method of grafting Citrus can be budded whenever the bark will lift, which can be expected in the months of November and March Unlike that of stone-fruits, two-year old wood of citrus is quite suitable for budding, and often buds inserted into limbs that are three and four years old will prove satisfactory However, one-year growth that is well matured will usually give best results. When it becomes necessary to rework mature trees, the best method is to remove all limbs about 1 ft above the main fork of the tree This should be done as soon as the spring growth commences, although where this is not possible the work of cutting back can be proceeded with until several months later The vigorous shoot-growth that arises from the remaining portion of the tree should be sufficiently mature to receive the buds before growth ceases the following autumn. These shoots are then thinned to the required number and the buds inserted near the base of the shoots Greater care and skill is required in the budding of citrus than in most other kinds of fruit-trees, and even under ideal conditions a skilled operator will seldom secure 100 per cent. of "takes."

Budding is accomplished by the insertion of a shield-shaped bud into a "T" or an inverted "T" slot cut in the bark of the one-year shoots. It is claimed that the latter method keeps out the moisture better A sharp knife is essential The bark is then lifted slightly at the junction of the vertical and horizontal cuts The bud is next cut from a stick of mature one-year wood, with the basal end held away from the operator The cut is made towards the operator with the knife blade almost parallel to the axis of the bud-wood This will give a shield-shaped piece of bark and wood about ¾ in to 1 in. long, with a smooth and flat cut surface The wood portion should not be "scooped" out. The bud is inserted beneath the bark and then pushed as far as possible along the vertical cut in the stock.

In selecting bud-wood, well matured plump shoots of the type that usually produce fruit should be selected Flat or angular growth is undesirable, likewise vigorous water-shoots.

A good grade of calico torn into strips about ½ in. wide and impregnated with grafting-wax is excellent for wrapping. The binding is started below the bud and the calico is wrapped firmly in a spiral manner until the entire length of the vertical cut is covered. The actual bud is completely covered in the process. After about fourteen to seventeen days the bud is examined, and if still green and showing callous formation the binding can be removed. Any failures can be rebudded immediately if the bark still lifts readily. If the bark by this time is adhering to the wood, further budding must be delayed until the spring growth commences. When the bud is inserted in the autumn the top is removed as soon as the spring growth commences by cutting just above the bud, and with spring budding as soon as the binding is removed.

THE COMMON FORM OF GREEN-SPOT.

"Green-spot" is the name given to markings which are often produced on lemons that are harvested when of a green or silver colour. The spots usually vary from a ¼ in. to ¾ in. in diameter, and are caused by the fruit becoming bruised at some stage before it is fully coloured. These bruises, when made, are not readily seen, except under close examination, consequently growers not curing their own fruit often fail to realize that such injuries have occurred. Fruit that is picked when in a wet condition is believed to be most readily affected. The accompanying photograph illustrates the common form of green spot.

Blue-mould (Penicillium italicum).—This fungus disease often causes considerable loss in citrus fruits both during the curing and in the interval between the packing and the sale of the fruit. During the months of October and November the disease is usually most troublesome, consequently special care should be taken with all fruit harvested at this time of the year. The fungus cannot enter a sound fruit unless it comes in actual contact with a decayed fruit. However, the slightest injury to the oil-cells is sufficient to allow the fungi to gain an entrance to the tissues of the fruit. These injuries are so small at times as to be invisible to the naked eye. Lemons that are harvested in a yellow condition are particularly susceptible to attack. There is a tendency on the part of some lemon-growers to allow small fruits to remain on the trees for several weeks after assuming the silver-green colour, particularly during the late winter and spring months Little, if any, size-increase takes place in the fruit by this practice, and the risk of blue-mould infection is greatly increased

—*P. Everett, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

Determination of Sex.

SEVERAL inquiries as to whether sexing is injurious have been received. In this connection it may be mentioned that in order to test out the effect of this operation the Department had a batch of chickens sexed on the 2nd September, 1935. The sexed pullets were reared separately. The average weight of the 204 one-day-old sexed pullets was 1·33 oz., as against an average weight of 1·47 oz. for 274 one-day-old mixed White Leghorn chickens, which would indicate that one-day-old cockerels are slightly heavier than one-day-old pullets. At six weeks old the 126 pullets which had been reared with cockerels averaged only 10·39 oz, as against an average of 12·66 oz. for the sexed pullets, thus showing that the sexed pullets grew better when reared by themselves. It would also indicate that sexing had no ill effects.

The approximate cost of feeding the chickens up to six weeks old was 2½d. each

Forty of the sexed pullets, which were reared on a dry mash, were kept separate, and comprised one of five pens of forty pullets each. Each pen of birds was fed on a different ration, and the pen of sexed pullets laid more eggs during the test than any of the other four pens, which were made up of pullets that had not been sexed After the test was over some of the birds were culled on account of their not being up to standard, just as any flock requires to be culled.

The rest of the hens are now entering their second laying-season, and they have shown no ill effects from the action of sexing.

It may be of interest to mention that the cockerels sexed from the batch of chickens in question were sold as day-olds. The purchaser reared them and kept the best for breeding purposes, and the results were quite satisfactory.

Judging from these tests, together with reports from poultry-keepers who have had large numbers of chickens sexed, it may be said that provided the work is done by careful, experienced operators, there is little danger of any ill effects.

In order to diagnose the sex of one-day-old chickens accurately and quickly, a person requires to be in practice, have good eyesight, plenty of light, and a retentive memory. It is quite possible for an inexperienced person, especially if the light or eye-sight is not too good, to cause injury by applying too much pressure when sexing, and for this reason poultry-keepers would be wise to see that competent certificated persons only are engaged to do the work. At times, if ovarian trouble is experienced amongst sexed pullets, there is a tendency to think that the birds were injured while being sexed. Experience has shown, however, that if injury is done while diagnosing the sex the injured birds do not live long.

Vent-picking.

Vent-picking is usually started by one hen picking the vent of another whilst it is in the act of laying The picking causes bleeding and laying keeps the wound open. Protrusion of the oviduct often follows, or the wound becomes septic, when a whitish discharge comes from the vent. One bird will often start the trouble and cause almost an epidemic in a flock, for once birds acquire the taste for blood they seem to watch for other birds laying and then attack them. Treatment of victims is of little value The best plan is to remove the culprit at once, if possible darken the nests, and keep the birds busy by increasing the depth of litter and scattering a little scratch feed about during the morning.

The Season getting on.

On a general farm where only a small flock of poultry is kept and the hatching and rearing are done by natural means it is often difficult to get broody hens before this time. However, if not already done, every effort should be made to get all the chickens required hatched out as soon as possible.

September is looked upon as the best month of the year in which to hatch chickens, although many prefer August for hatching out chickens of the heavy breeds. Most of the large poultry-farmers try to get all their stock hatched out before the end of September, as experience has shown that, where large numbers of chickens are raised artificially, those hatched after September do not do so well, especially if the months of October and November are dry and warm. October hen-hatched chickens, especially of the light breeds, provided they are reared on fresh, sweet ground and are well looked after, should come into profit during April, but later-hatched birds do not as a rule do well, and seldom come into profit until the winter is over and eggs are cheap

Selecting Broody Hens.

As all broody hens do not make satisfactory sitters or mothers, care should be taken to select those of a quiet, docile temperament, and avoid the wild, nervous birds. Some hens are naturally clumsy, while others will sit for a day or two and then leave the nest, so for these reasons it is advisable to set the hen on some dummy eggs for a few days, and when satisfied the bird is really broody and of a gentle, quiet temperament, the more valuable eggs should be placed under her.

It is never advisable to set broody hens in the fowl-house or laying-shed, where they are liable to be disturbed by other hens, and where they are more likely to become infested with insects. The better plan is to build a light coop, with run attached, which can be moved on to fresh ground regularly. Such a coop can be cheaply erected and should give good service for a long time.

As more hen-hatched chickens and young turkeys are lost each year from the ravages of insects than from any other cause, it is advisable to see that all broody hens are treated for insects. A simple and effective method is to dip the end of a feather into nicotine sulphate and draw this under both wings and amongst the breast feathers, or dust the bird with insect-powder. This should be done when the bird is first set, and again in about ten days' time, but it is not safe to treat birds with chickens, or sitting hens just before the hatch comes off. The nest is best made on the ground, in order that the eggs may get moisture, otherwise the skin inside the shell is liable to become too dry and tough for the chicken to cut through. Make the nest saucer-shaped, flat on the bottom, and just deep enough to cause the eggs to have a tendency to roll towards the centre, and flat enough to prevent them from piling up when the hen turns them.

Plenty of soft, pliable nesting-material, such as oat-straw or pine-needles, should be used. Should an egg get broken and the contents become smeared over other eggs, it is advisable to wash them in warm water and renew the nesting-material.

If sitting hens are closed in a coop or box, care should be taken to see that plenty of fresh air is available They should be allowed to come off once a day. Grain, water, and grit are all in the way of food that sitting hens require. It is better to avoid giving mashes, especially sloppy food, as such are likely to cause looseness of the bowels, and the eggs to thus become soiled. The less sitting hens are disturbed the better, especially at hatching-time.

It seldom pays to help chickens out of the shells.

Feeding and Care.

There are many different methods of feeding chickens, and in many cases success depends more upon how the birds are fed and cared for than upon what is fed. They should be fed at fixed times and at regular intervals, the first feed as early as possible in the morning and the last just before dusk Feed fully and give plenty, but do not leave food lying about to become sour.

Chickens can only be expected to do well when their quarters are kept dry and clean. Dampness is dangerous as it is likely to cause filth from droppings, and disease may result.

As stale ground is responsible for a great deal of unthriftiness, it is advisable to arrange for chickens to be reared on fresh ground, apart from where adult birds have been running.

Those desiring full particulars of two methods of feeding chickens which have given good results at the Wallaceville Poultry Station may secure copies of same on application to the writer.

—*C J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Feeding and Water.

A CONSTANT watch should be kept on the stores in the hives. Usually at this period there is a steady drain on the food-supply to meet the incessant demand for brood-rearing. If an examination of the hives was carried out, as advised in my July and August notes, then the losses attendant upon spring starvation will have been avoided ; but it is not wise to neglect to feed where stores are short, as the spring is the most critical period for the beekeeper. The weather conditions are not always favourable for the bees to work the early spring blossoms, and in populous colonies the food-supply should be augmented, but only where there is a noticeable shortage. If there is a good queen in the hive she will usually begin laying as fast as weather conditions will permit, and it is a mistake to start feeding unless stores are very short, as it stimulates brood-rearing, and, when commenced, must be carried on until a natural flow sets in from the fields.

Abundance of stores is certainly required at this season, and if the beekeeper finds that additional food is required, it can be supplied in the form of combs of honey or as a syrup. The feeding of combs of honey should not be practised unless the beekeeper is sure that his apiary is free from disease, as there is always danger of spreading disease by this method. No better substitute for honey has been found than cane-sugar, and it is far safer to use it at all times if the beekeeper is not satisfied as to the health condition of his apiary. Honey from an unknown source should never be fed. There are many feeders on the market. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive.

In the spring months, when brood-rearing is at its height, bees require a good supply of clean water in the apiary. If this is not provided they are apt to become a source of annoyance at drinking-troughs and by congregating round domestic supplies. The brood requires a great deal of water in addition to pollen and honey. The amount depends largely on how much brood-rearing is going on, and to what extent nectar is coming in from the fields. If water is not close at hand many bees are lost in trying to obtain it, more especially as the weather is often changeable and boisterous in the spring.

Many simple contrivances can be made to supply water " Simplicity " feeders make excellent vessels for the purpose, but they require to be filled frequently. To start the bees taking water from any particular place it is a good plan to slightly sweeten the first water given.

When to start an Apiary.

One of the questions most frequently asked by the would-be beekeeper is, " When should I start beekeeping ? " Probably no time is better than when the bees are swarming. If the beginner procures a good prime swarm, leaves it in a clean box for three days, and then hives it in a new hive, on new frames, with full sheets of foundation, he has made the best start it is possible to make in beekeeping. The leaving of the swarm in a box for three days is purely a preliminary measure in case there is any disease in the apiary, from which the swarm is procured. By the end of three days the bees will have consumed the honey they brought from their old home, and at the same time have disposed of the foul-brood germs (which are innocuous to the adult bee), and be ready and willing to be transferred to their permanent home to start brood-rearing in earnest.

As the bees will have become used to their box by the end of three days, it is as well to carry out the transfer with care. It should be done at sundown on the third day. The hive should be placed in position, a clean sack spread over the alighting-board and surrounding ground, and the hive-body raised from the bottom-board about an inch or so by means of a stone or piece of wood. The box should be firmly grasped with both hands, inverted over the sack as near the hive as possible, and the bees dumped with a brisk movement on to the alighting-board. One shake will dislodge the greater part of the cluster, and the few remaining bees can easily be shaken out and the box taken away. Be sure the queen is out of the swarm-box, and the bees will crawl in a steady stream into the entrance, their progress becoming more rapid as soon as the queen has entered the hive. When the queen is safely inside, the hive body should be lowered and the entrance slightly contracted.

It is advisable to place a feeder inside the hive. Even if the weather is good and a fair supply of nectar available, a few pints of good warm syrup fed a day or two after hiving will work magic with the new colony, and enable it to build up in time to yield a surplus when the main flow sets in.

The beginner should always start in the spring, and on no account should he attempt to commence with established colonies unless they are purchased from a breeder who guarantees his bees to be clean. Old hives are too apt to be homes of disease, and are only fit to be handled by the experienced apiarist.

—*E. A Earp, Senior Apiarist.*

HORTICULTURE.

Vegetable Crops.

THE sowings for the month of October include the half-hardy crops of dwarf and runner beans, marrows, pumpkins, and cucumbers, also the winter crops of savoy and red cabbage, kale, cauliflower, and broccoli for planting out early in the new year. In districts where the season is not sufficiently long to grow an autumn-sown crop of red beet, a good main-crop sowing may now be made for winter use.

The beans may be used green, in the pod, or shelled, or dry; in the latter form the white, light-green, and pale-dun haricots are a popular nutritious vegetable available throughout the winter months. A light, rich, warm soil is most suitable for this crop, and where lime has been used a dressing of 1 oz. or 2 oz. of superphosphate to the square yard will be beneficial Sow thinly so that plants stand at intervals of 3 in or 4 in., and leave 2 ft between the rows of dwarf varieties. Drills are made 2 in. or 3 in deep, the latter being adopted where the land is light The runner bean, a different botanical species to the preceding, is a perennial plant, and may be cropped for two or three years before resowing in a fresh locality.

The soil required by the gourds is very similar, rich in humus, moist, but well drained. Cucumbers may be sown to stand 12 in. to 18 in. apart and 5 ft. to 6 ft. between rows, marrows and pumpkins 3 ft. to 4 ft. between plants, with a greater distance between rows for varieties with strong runners when planted on a rich soil Marrows are best cut green for immediate use so soon as they are of sufficient size, and the pumpkins allowed to ripen off and stored for winter use. Seed-beds of cabbage and other plants of the same family will require close attention to keep them free from insect pests. It will be the easier if remnants of older crops of the same class are cleaned up promptly so that pests are not readily carried over to succeeding crops.

So soon as danger of frost is past, kumara, or sweet-potato plants, may be set out; this will be, in many instances, early in the month of November or even later, but it should be as soon as possible, as the crop requires a long season to give best results. Meanwhile the rooted shoots are kept heeled-in closely in a sheltered bed where they are readily protected with covers in severe weather.

The soil most suitable for this crop is light, moderately rich, and clean. Where the quantity of manures or fertilizers used is small, it is generally best placed beneath the ridges on which the plants are set; larger dressings should be broadcasted and turned under. Where there is a possibility of a dry season planting is best done on the flat, otherwise a low, broad ridge will be warmest and give best results. Plants are usually set 18 in. apart and 2½ ft. to 3 ft. between rows. Planting is best done after rain, but if the weather is dry the plants should be watered in.

With rising temperatures, especially where they reach over 60° F., growers of mushroom crops are finding difficulty in controlling insect pests. It is the greater on the older establishments, where a rigorous system of plant hygiene has not been observed, and especially when the crop is grown in sheds from which insects may not readily be excluded and where effective fumigation cannot be given. The commoner pests are mushroom-flies (*Sciara*), manure-flies (*Phoridae*), and Springtails (*Collembola*). Where the house may be closed tight these pests can be destroyed by fumigating with nicotine, a half to one fluid ounce per thousand cubic feet, otherwise nicotine sulphate, one ounce to four gallons water, may be used as a spray. In this regard it should be noted two ounces of lime hydrate should be used in the place of the usual soap ingredient, which is injurious to the mushroom crop. Another remedy is dusting with a pyrethrum powder of the highest grade. These treatments destroy the insects but not the larvæ and therefore should be repeated at intervals of two or three days, as may be necessary, to destroy the flies as they emerge.

Small and Sundry Fruits.

Under glass the tomato crop will be setting the fruit and the success of this critical period of development depends very largely on maintaining a suitable atmosphere. Cold draughts, close humid conditions, and sudden changes are inimical. Watering when necessary should be done in the morning, excessively high or low temperatures should be anticipated and the ventilators adjusted to maintain a warm buoyant atmosphere. In warm districts a little ventilation will be required now even at night. Unless glasshouse crops can be given this close attention they are rarely profitable.

During the month of October, chiefly towards the end, the first batch of tomato-plants for outside cropping are usually planted Set deep and firm, carefully avoiding injury to the stem, sturdy plants should do well if the land has been well prepared. Spacing, whether stakes or trellis is used, is generally 12 in. to 15 in. between plants and 3 ft. between rows.

Other half-hardy plants of this class which are planted outside at this time are passion-fruit, tree-tomatoes and Cape gooseberries, also melons and cucumber-plants which have been raised under glass. If they have been purchased or come from a distance it is as well to place them in the hardening-off frames for a while, to be sure of their condition before planting them out.

Rather more tender than the above-mentioned are peppers and egg-plants, which are planted out a fortnight or so later, when there is practically no danger of a damaging frost. With the greater interest now being taken in salads and fruit by the general public, these crops demand greater attention from commercial growers, with a rich light soil in really warm districts. The egg-plant, probably a native of India, has long been in cultivation, and has much the same cultural requirements as the tomato, except that it is more tender and requires a rather longer growing-season. For this reason they should be well advanced in growth before planting out; preferably they should be in pots so that transplanting will interfere with growth as little as possible; 2 ft. apart and 3 ft. between rows is usually suitable spacing. Peppers, or capsiums, probably originated in tropical America, and were among the many food plants introduced into Europe from that source after the great discovery. They require much the same attention as the preceding, but may be planted rather closer, the plants being set 18 in. apart with 30 in. to 3 ft. between the rows. There are a large number of varieties which may be roughly divided into those with fruit which is "hot" or pungent as Tabasco, and Cayenne, and others which are known as "cool" or sweet, and are in demand for serving as stuffed peppers and use in salads.

Strawberries showing signs of a fair crop may now be given a dressing of nitrogenous manure with advantage just before applying the mulch. For the latter purpose clean, baled straw that has been weathered to destroy seeds is very suitable; rushes and pine-needles are sometimes used. To keep the berries free from grit thrown up by splashing rain something of this kind is usually necessary.

The Homestead Garden.

If flowering shrubs are studied it will be noticed that they flower best either on the old wood—or the young wood, that is, one-year-old wood—or the new wood as do roses. On this chiefly the pruning treatment required depends. Early-flowering shrubs of importance that carry their blossom on the young wood such as forsythias, lilacs, double-flowering peaches, Banksia rose, acacia, &c., are greatly benefited by cutting away the wood so soon as flowering is over to admit the light and air which are so necessary to the young growth that follows and is to flower next season. If favourites are given this attention their gratitude will be generously expressed by the enhanced display that will follow. Suckers also should be suppressed, as they represent so much wasted energy, and they, too, interfere in the development of legitimate growth. For this reason all rank superfluous growth inclined to crowd the plants should be suppressed. Rhododendrons rarely make sufficient growth to require much pruning, but it is well worth while removing the seed-pods from heavy-flowering varieties so soon as the petals have fallen.

As the time is arriving for setting out summer bedding-plants some preparation should be made. The fragrant stocks, the glowing zinnias, and the delicately coloured asters each have their appeal, and provide wholesome pleasure when well grown. This is best attained by strictly limiting the area planted and doing it well. The foreground of the shrubbery border so often used is rarely suitable as the interests of the respective crops often seriously clash. As the name bedding-plants indicates, they are best grown in beds or borders specially set aside for the purpose so that the proper treatment may be given. With the continuous cropping these receive there is a danger of them becoming deficient in humus, without which good results cannot be obtained. It may be supplied now by turning in a good supply of decayed farm manure. If 3 oz. or 4 oz. of bonedust to the square yard is included, success should be assured if good plants are set out in a tasteful manner. An ounce or two of superphosphate to the square yard hoed in shortly before planting would supply their more immediate need for phosphates.

Good plants are dwarf, bushy, and well rooted. It is important too they should be well hardened off and not suddenly transferred from the glasshouse or hotbed, which would cause them to become stunted in their growth. Cheap plants are very tempting, and the assurance they will make good is very plausible, but the advice previously given to limit the area and do it well is the best policy.

The "planting-season" during which hardwooded plants generally can be transplanted satisfactorily is now drawing to a close. Where new planting of this kind has been done, it will be sufficient to suppress the growth of weeds and grass in the vicinity that might rob the young plant of its requirements of light and air, and, should the season or locality be dry, a mulch of stable manure or humus about each plant will be of assistance in retaining moisture.

—*W. C. Hyde, Horticulturist, Wellington.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PLANTING TREES ON GORSE LAND.

B. S. H., Cambridge :—

I propose planting an area of gorse land in trees, the gorse is about 6 ft. high, but not particularly dense Would you please advise me a simple yet efficient way to prepare this land for planting year-old trees ? I presume that so long as the gorse is checked sufficiently to prevent choking out the trees, there will be no need to grub the gorse The trees will be chiefly varieties of eucalypts.

The Fields Division :—

Eucalyptus will not smother gorse, and the most economical method would be to grub the pest before planting the trees. The eucalypt habit of growth affords ample sunlight to weed pests, consequently they thrive luxuriantly under the trees, requiring periodical cutting, &c Should you decide to plant the trees amongst the gorse the land requires little preparation. For one-year-old trees a hole about 2 ft. square is ample Holes should be dug well ahead of planting, so that the soil has as much weathering as possible A dressing of blood and bone mixed with the soil at the rate of ½ lb. per tree is recommended

PAMPAS GRASS.

A. V. B., Waitahora, Dannevirke :—

Will you please advise me as to the growing of pampas grass, and where seedlings may be obtained

The Fields Division :—

Although pampas grass will establish and grow almost anywhere, like all other plants the rate of growth and vigour of the plant varies considerably with the soil and moisture conditions. Pampas grass grows best on rich, moist, drained swamp land, but will also give satisfactory growth on any medium to good farm land, particularly in damp situations, though it does not like water-logged conditions The plant can be grown from seedlings or from rooted cuttings, from an old plant. As with marram grass, the best cuttings are taken from young two- to three-year-old plants, the side shoots being cut off below ground so that some of the roots are retained on each cutting. Seedlings were at one time supplied by Messrs A Yates and Co., Seed and Manure Merchants, Auckland. All plants, whether seedlings or cuttings, should be heeled in in good garden soil, and kept watered until the plants strike. It is necessary for early spring planting, therefore, to have plants on hand about May Plants obtained in the spring should be kept in the garden and attended to until the following autumn, when they can be put out in permanent position in April or early May The best time of planting out is in August or early September, and plants should therefore be obtained in the previous autumn. In heeling in or planting out the earth should be packed tightly round the roots and the soil kept moist and loose at the surface, though very firm below. For shelter or fodder pampas is planted in rows 6 ft. apart with 6 ft. between the rows, 1,000 plants being required per acre. It must be well protected from cattle, as continuous grazing will kill even fully grown plants. A certain amount of light cultivation round the plants during establishment and a light dressing of super annually will do much to push the growth forward when once full grown and fit to feed off, which may take anything from two to four–five years, according to soil conditions, &c. The grazing-off of the plants will be followed by a rapid growth sufficient in most cases to give about the same amount of leafage as was on the plants when first fed off. After feeding off, say, in the winter, it is necessary, therefore, to close the area immediately until the following winter. It is best also to feed off if possible in breaks, rather than as a whole. An established and well-grown area of pampas grass would provide a permanent winter-feed reserve for cattle, and could be made of particular value to the sheep-farmer who requires to winter cattle for feed-control purposes in the spring and summer. Pampas grass is also a valuable fodder for wintering dry cows on the dairy-farm.

WEATHER RECORDS: AUGUST, 1937.

Dominion Meteorological Office.

NOTES FOR AUGUST.

AUGUST is normally regarded as the last month of winter, but that just past was mild, pleasant, and distinctly spring-like in character The cold of the early winter caused a shortage of pasture in many districts during the first part of the month, and it was necessary to resort to hand-feeding of stock The dry weather accentuated this condition In addition to pastures, the wheat crops in mid-Canterbury and North Otago suffered considerably, and mild rains are badly wanted there and at some other localities Over most of the country, however, there was fairly rapid growth of vegetation during the latter half of the month, and stock have kept in fair condition. The weather was favourable for lambing, and the losses have been relatively light.

Rainfall.--The month was a particularly dry one over most of the Dominion The greatest defects from normal rainfall occurred in the southern half of the North Island and the eastern area of the South In some places it was the driest August ever experienced In parts of eastern North Auckland, in the Bay of Plenty, and in the Gisborne area, however, the average was exceeded.

Temperature.—At a few places in North Auckland and in Hawke's Bay the mean temperature was slightly below normal, but over the remainder of the country the normal was exceeded. The departure was in the vicinity of 0°·5 in the North Island, but greater in the South, and at places in the western and far southern districts it exceeded 2°

Sunshine.—There was a prevalence of cloudy weather, and the amount of bright sunshine recorded fell below the average for August, the deficiency being greatest in the eastern districts of the South Island.

Pressure Systems.- One storm system alone during the month caused generally disturbed conditions. This was a deep depression of the westerly type which passed between the 3rd and the 7th. Strong winds and fairly general rains occurred during this period, the worst effects being experienced on the night of the 6th and on the 7th, when a severe south-westerly gale blew in most districts, with hail and snow in places. By the 8th the front of an anticyclone had extended on to the Dominion, and from then until the 26th pressure remained high.

An intense cyclonic depression, which was located off the New South Wales coast on the 21st, moved very slowly across the Tasman Sea during the next few days, and from the 23rd to the 27th was responsible for north-east winds and mild, dull, misty weather in the Dominion, with scattered rains The latter were mostly light, but some heavy falls occurred at places in North Auckland and on the east coast of the North Island. By the 27th, when it had at last crossed the Dominion, the cyclone had become a very shallow one, and the southerly which was associated with its rear was very mild.

Anticyclonic conditions and fine weather again ruled on the 28th and 29th, but on the latter day a fresh cyclonic depression formed to the north-west of New Zealand. This moved slowly, at first, in a south-easterly and later in an easterly direction, passing Cape Maria van Diemen to the northward on the 30th. Dull and misty weather prevailed over most of the country. Gales from between east and south-east blew in the northern and eastern portions of the North Island on the 30th and 31st, accompanied in many places by heavy rain. In the Bay of Plenty some flooding occurred.

RAINFALLS FOR AUGUST, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Fall.	Total Rainfall to Date.	Average Rainfall to Date.
			North Island.			
Kaitaia	2·48	10	0·78	5·12	44·34	38·76
Russell	13·97	15	5·85	5·52	82·25	42·86
Whangarei	9·39	20	3·42	6·31	66·77	45·10
Auckland	1·53	13	0·40	4·61	31·75	34·47
Hamilton	2·03	8	1·25	4·11	28·36	33·11
Rotorua	2·14	5	1·03	4·91	33·02	36·76
Kawhia	1·08	6	0·40	4·63	25·10	36·18
New Plymouth	1·54	7	0·65	5·49	40·13	40·41
Riversdale, Inglewood	2·52	9	1·17	8·89	63·07	67·60
Whangamomona	0·47	3	0·24	6·02	46·16	48·99
Hawera	0·87	7	0·23	4·50	27·49	30·11
Tairua	3·06	13	1·13	5·84	40·54	45·71
Tauranga	4·66	11	2·88	4·30	38·34	36·12
Maraehako Station, Opotiki	3·49	8	1·58	5·48	43·51	37·73
Gisborne	6·92	14	2·24	4·33	29·66	34·29
Taupo	0·99	6	0·57	4·07	21·59	29·30
Napier	1·98	10	0·95	2·95	16·82	22·30
Hastings	2·25	10	1·06	3·15	13·69	23·42
Taihape	0·57	8	0·36	2·74	20·59	23·52
Masterton	1·75	13	0·55	3·59	22·81	26·54
Patea	0·85	7	0·28	3·81	28·01	29·44
Wanganui	0·82	6	0·32	2·81	21·13	23·85
Foxton	1·42	4	0·77	2·95	15·32	21·33
Wellington	1·03	8	0·31	3·93	23·62	29·67
			South Island.			
Westport	3·00	7	1·29	7·70	53·64	62·50
Greymouth	2·39	14	0·70	7·48	66·72	64·97
Hokitika	5·29	12	1·21	9·24	72·19	73·29
Ross	8·36	12	2·20	10·43	85·65	82·38
Arthur's Pass	2·96	8	0·84	10·20	92·14	96·07
Okuru, South Westland	7·82	6	2·24	11·24	99·12	93·80
Collingwood	2·36	5	0·98	7·11	56·18	62·09
Nelson	1·89	7	0·76	3·06	23·90	24·86
Spring Creek, Blenheim	1·58	8	0·75	2·75	17·53	20·64
Seddon	2·40	9	1·43	1·90	16·42	16·62
Hanmer Springs	1·00	8	0·26	3·42	21·32	29·48
Highfield, Waiau	1·10	5	0·75	2·45	14·57	22·53
Gore Bay	2·02	6	1·30	2·64	22·28	21·31
Christchurch	1·76	11	0·83	1·82	16·47	16·99
Timaru	1·01	8	0·57	1·45	14·61	14·43
Lambrook Station, Fairlie	0·51	5	0·20	1·53	12·81	16·13
Benmore Station, Clearburn	0·97	7	0·27	1·48	18·57	16·02
Oamaru	0·76	9	0·15	1·74	11·25	14·44
Queenstown	1·05	6	0·62	2·05	19·72	19·43
Clyde	0·76	4	0·35	0·79	11·13	9·45
Dunedin	1·90	14	0·63	3·07	30·06	24·13
Wendon	1·77	10	0·40	2·05	31·11	19·27
Balclutha	1·33	10	0·36	1·78	24·51	16·27
Invercargill	1·99	17	0·44	3·20	30·30	29·78
Puysegur Point	5·16	21	1·28	6·94	61·39	55·35
Half-moon Bay	2·15	15	0·57	4·39	42·18	37·92

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RECLAIMED TIDAL LAND AT PIPIROA.

THE VALUE OF STRAWBERRY-CLOVER.

By J. E. BELL, Instructor in Agriculture, Auckland.

THE littoral clay soils of the Hauraki Plains dry out quickly in dry weather. At Pipiroa there are about 800 acres of reclaimed land which have been stopbanked from sea and river and drained. This area is roughly triangular in shape and is bounded on the north by the sea-coast and on the east by the Piako River. The soil is a stiff clay. The drains, which were dug, proved reasonably effective, and after the land became sufficiently free of salt the area was sown in pasture. This soon grew luxuriantly, and the resultant sole of rye-grass and white clover supported highly productive dairy herds, and was famed on the Hauraki Plains for its health-giving and fattening properties. After a few years of dairying, and probably as the result of winter trampling and puddling of the soil entailed by dairying, the drainage system became less efficient. About fifteen years ago deterioration of the pastures was first noticed, and culminated in the dry summer of 1928–29 in the disappearance of almost all the pasture-plants on the reclaimed land and also on other patches, on clay soils in the vicinity of Pipiroa, and also on isolated areas as far inland as Ngatea. The depleted areas comprised, in all, about 1,000 acres of land. The worst damage was apparent in the reclaimed triangular area at Pipiroa, which was almost bare of vegetation. At the margins of this area and on the other areas almost all the grass was dead, but the dead stalks of grass were still to be seen. Throughout the depleted areas there were still alive a few patches of *Poa pratensis* and prairie-grass, and odd plants of tall fescue and meadow-foxtail. These grasses did not appear to suffer much.

One piece of ground at Pipiroa was conspicuous for its distinctive green colour—a patch of strawberry-clover (*Trifolium fragiferum*) a few square yards in extent in one of the fields on Mr. J. Mangan's property. This patch, no doubt the result of the establishment of one seedling, was to play, and continues to play, an important part in the rehabilitation of the area at Pipiroa, but its virtues were not fully realized till later. What had occurred was the destruction of the rye-grass and white clover, which held so dominant a position in the pastures that their disappearance left a desolate desert.

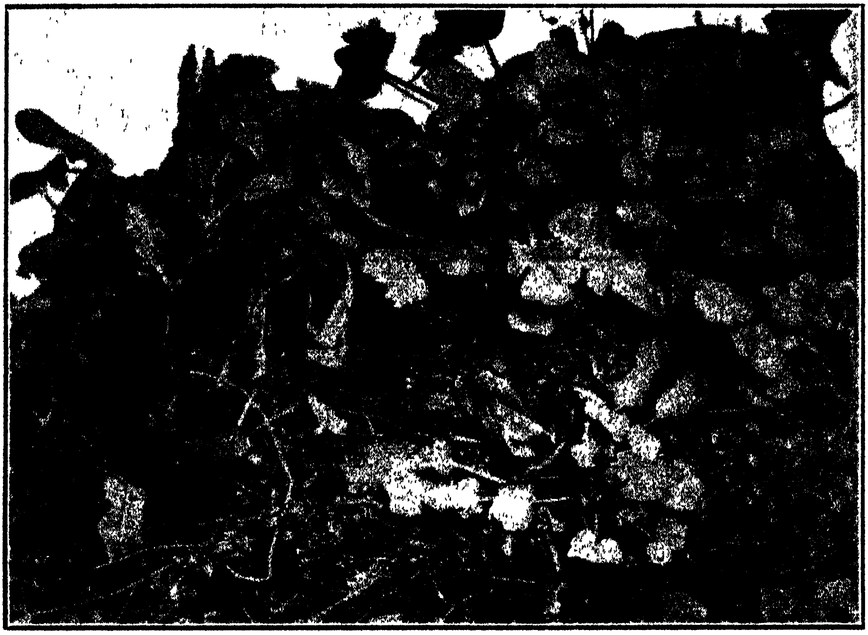

FIG. 1.—THE DEPLETED LAND AT PIPIROA. BARE GROUND, BUTTERCUP, DOCKS.

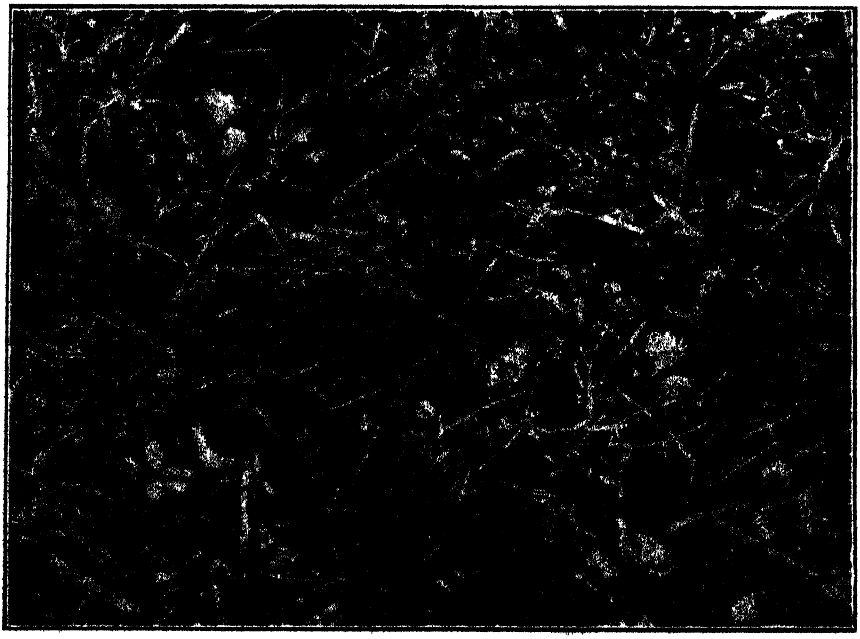

FIG. 2.—A PASTURE OF REVERSED CLOVER AND POA ANNUA, WITH ODD PLANTS OF BUTTERCUP, LOTUS, AND RYE-GRASS.

SETTLERS IN SORRY PLIGHT.

The settlers were in a sorry plight, and, as a result of their complaints, the country was examined by officers of the Department of Agriculture. The bare soil had cracked very badly, and these cracks formed ideal homes for crickets, which were present in their millions They would hop and flutter in dozens at each step of the visitor as he walked across the fields. They nibbled the remaining pasture and anything lying about that was eatable, and were even known to devour clothes and to fight and eat each other. A caterpillar of the *Porina subterranea* species was also present on the marginal land, where the grass was dying and where the ground was still covered by dead stalks of rye-grass

Various opinions were expressed by farmers and others as to the cause of the depletion. Many farmers blamed the crickets, and said that they were the sole cause of the trouble, while others were as emphatically of the opinion that the crickets were not entirely to blame The presence of the *Porina* led a few to believe that this caterpillar, after destroying the rye-grass, had disappeared from the bare areas and was working its way along the marginal land and in freshly attacked patches, making further inroads into the untouched grassland Others believed that the trouble was caused by the surface layers of the soil becoming poisoned by salt deposited there, as the soil moisture, with the salt in solution, rose by capillarity and evaporated at the ground surface This trouble would be prominent in dry summers, yet there was no visible sign of alkali on the ground surface. Another theory was that, as the area was not well drained, the puddling of the area by dairy cows each winter had resulted in an alteration of the physical nature of the clay, so that it cracked and dried out so badly in the summer that the rye-grass died.

Investigations were started in 1929–30, the season following the year of marked deterioration. An area was sown down in various mixtures of grasses with a basal clover mixture of white clover, strawberry-clover and *Lotus major*. The area was manured with ammoniated super. Later it was realized that this manurial dressing was unsuitable for sowing down, due to its inimical effect on clover establishment. Certainly the pasture had to struggle to live, and in the early periods the death of the grasses was feared. Fortunately the 1929–30 summer was a wet one, the following five seasons were not dry ones, and gradually the pastures on the trial area improved and finally became fairly well established. The following grasses were tried: perennial rye, Italian rye, meadow-fescue, *Paspalum dilitatum*, cocksfoot, crested dogstail, meadow-foxtail, *Poa trivialis*, timothy, and *Phalaris bulbosa*. Different chemical treatments were tried, including super, slag, carbonate of lime, gypsum, 30 per cent. potash salts, sulphate of ammonia, sulphur, nitrochalk, and manganese sulphate.

SEASONAL CHANGES.

In the meantime parts of the depleted area showed amazing changes at every season of the year. The bare ground became colonized chiefly by buttercup, dock, pennyroyal, and sowthistle (all high-fertility-demanding weeds), and by *Poa annua*, goose-grass, reversed clover (*Trifolium resupinatum*), and *Lotus major* and *Lotus hispidus*. Favoured well-stocked areas such as night paddocks contained much reversed

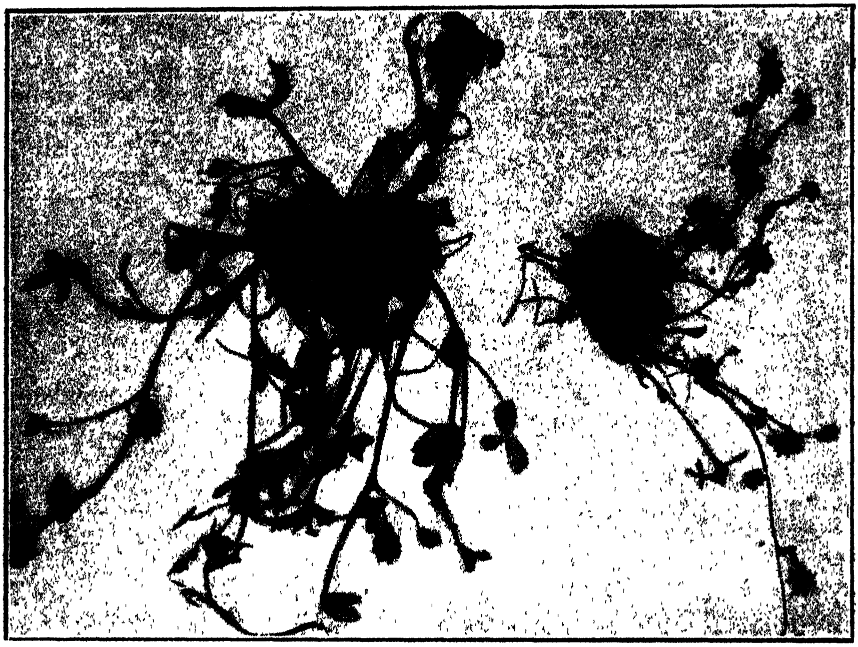

FIG. 3.—TWO PLANTS OF REVERSED CLOVER, SHOWING HABIT OF GROWTH AND THE TYPICAL SEED-HEAD.

FIG. 4.—STRAWBERRY-CLOVER STOLONS INVADING DEPLETED LAND, WHICH WAS MAINLY BARE GROUND, WITH ODD PLANTS OF BUTTERCUP, SCOTCH THISTLE, AND LOTUS.

clover and *Poa annua*, and a little perennial rye, while less favoured areas were only sparsely colonized by *Lotus major* and weeds. If two consecutive wet summers were experienced, white clover and volunteer rye-grass would reappear in some of the fields, and these for a time would be quite highly productive. Under clumps of trees, particularly around homesteads, where excessive grazing was not allowed, and where the tree-roots prevented undue trampling by stock, patches of prairie-grass, thriving very well indeed, could be seen. One or two attempts were made to establish prairie-grass in the open fields, but it did not prove to be of high production under such conditions. On one of the night paddocks meadow-foxtail was present to a fair extent. On some hayfields there would be much goose-grass, a pasture-plant of low production. There was also one patch of *Agropyron repens* permanently established. The dry-soil condition in the summer was suitable to this grass, which, however, was in a rather sodbound condition, with no clover present in its midst. In consequence its production was only fair, and it was neglected by stock. All these different types of pasture, although welcome because they provided some feed, were viewed as unsatisfactory by the settlers, who had been accustomed to, and expected to see, permanent high-class swards of rye-grass and white clover.

Most of the farmers adopted the policy of *laissez-faire*, which perhaps was the most sensible one to adopt. Some attempted to grow crops of maize, barley, soft turnips, and other supplementary crops for their cows. These were grown with difficulty, as the soil was wet and heavy and difficult to cultivate, and once cultivated was very soft in the winter. Of the crops, maize gave the best results, and barley was quite successfully grown. Small patches of lucerne were grown with slight success by one or two farmers, but the ground was too wet for the production of good crops.

HEAVY CROPS OF HAY.

In autumns following dry summers the annuals and some perennials would establish themselves from seed and would form root systems throughout the winter months, but during this period of establishment the production of leafage was poor. *Poa annua* gave most of the fodder, and, though of slow growth, produced highly palatable and nutritious feed, and proved a very useful volunteer. The reversed clover produced very little feed in the winter, but in the spring fields colonized by it grew an enormous amount of highly nutritious fodder. Extremely heavy crops of hay, of up to 3 tons per acre, were secured from this clover, the growth of which in favourable seasons suppressed almost all other plants in the sward. Reversed clover has a leaf very similar to white clover in appearance, being hairless and of as fine a texture. It forms small rosettes in the winter and early spring about 6 in. in diameter. In the spring it sends up tall upright stems about 3 ft. long (some specimens have been reported to be 5 ft. long). These stems are slender (much finer than lucerne), and hay crops usually lodge and are difficult to cut. The flower-head is small and contains about twenty-five florets like white clover florets, only they are of a light purple colour. Each floret develops a single seed, which becomes

FIG. 5.—STRAWBERRY-CLOVER INVADING IN MASS FORMATION PRACTICALLY BARE GROUND.

Notice the dead stalks of pennyroyal on the uninvaded territory

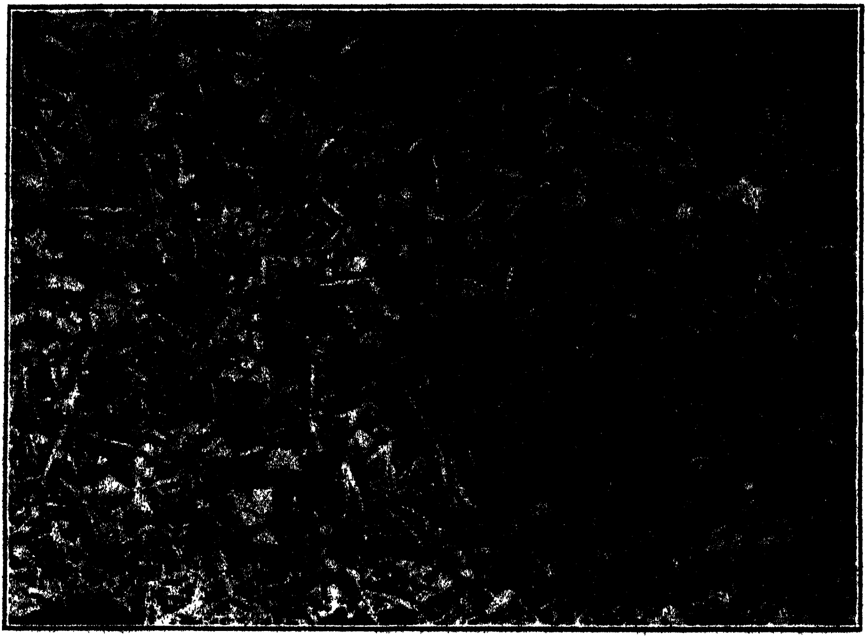

FIG. 6.—STRAWBERRY-CLOVER WELL ESTABLISHED ON DEPLETED LAND.

enveloped in a veined diaphanous capsule. When the capsule has enveloped the seed the seed-head has a strawberry-like appearance, and is about ¾ in. in diameter, much larger than the flower-head.

By Christmas both the *Poa annua* and the reversed clover would be dead, and in the dry Januaries and Februaries usually experienced practically no vegetation would be produced. In wet summers there would be some white clover and *Lotus major* growth. Thus as the seasons varied and the management changed on the different fields, so the sward would alter with lightning rapidity (or so it would appear to the periodic visitor). One wet summer encouragement would be given to the presence of white clover and some rye-grass on favoured areas. Next spring there would be the usual thick tangled mass of reversed clover, then a dry summer and a hopeless looking bareness. Always a fight was going on between annuals and perennials. Wet summers favoured the survival of perennials, and thicker swards of these in the autumn meant less and weaker annuals and a poorer showing of them in the spring. Dry summers meant death to perennials and a bare soil for the seedling of many annuals, which were then not hampered by perennials in their establishment in the winter, and grew vigorously. The weakness of a pasture populated chiefly by annuals was very evident, the production from January to September being very low. In spite of the very high production during the remainder of the year by reversed clover, the butterfat-production was only a fraction of that when the area was carrying a sole of perennial rye-grass and white clover. A pasture of this kind would not perhaps be quite as high-yielding in the spring, but its production during the rest of the year would eclipse that of the annuals now growing in its place. Most of the area was not evenly thickly populated by annuals, and the production was low in the extreme.

MANURIAL EXPERIMENTS.

The manurial experiments were of little value, for most of the treatments made no impression, and the others had little noticeable effect. The most promising of the treatments were super, slag, and potash. The only grass that proved of value in the trials was perennial rye-grass, and this established itself only where there was a good sole of volunteer reversed clover or strawberry-clover. The rye-grass was most vigorous and plentiful where strawberry-clover was well established. All other grasses except *Phalaris bulbosa* and paspalum made a showing. *Phalaris bulbosa* has become aggressive, and not being liked by stock is proving a nuisance. The paspalum threw very little feed.

STRAWBERRY-CLOVER ESTABLISHED.

In the 1934–35 season there was another dry summer almost as arid as the summer of 1928–29, and, with the exception of a few patches, the pastures once more disappeared on the deteriorated areas. These patches when examined proved to be areas where strawberry-clover had established itself. Some of the settlers had suspected by now that the cure of the trouble was strawberry-clover establishment. One or two had commenced to sow and plant it in their fields, and the one patch which had demonstrated its value in 1928 had now spread, chiefly by natural means, over several fields.

FIG. 7.—THE FINAL STAGES—A STRONG PASTURE OF RYE-GRASS AND STRAWBERRY-CLOVER, WITH WEEDS AND ANNUAL AND INFERIOR PASTURE-PLANTS ELIMINATED

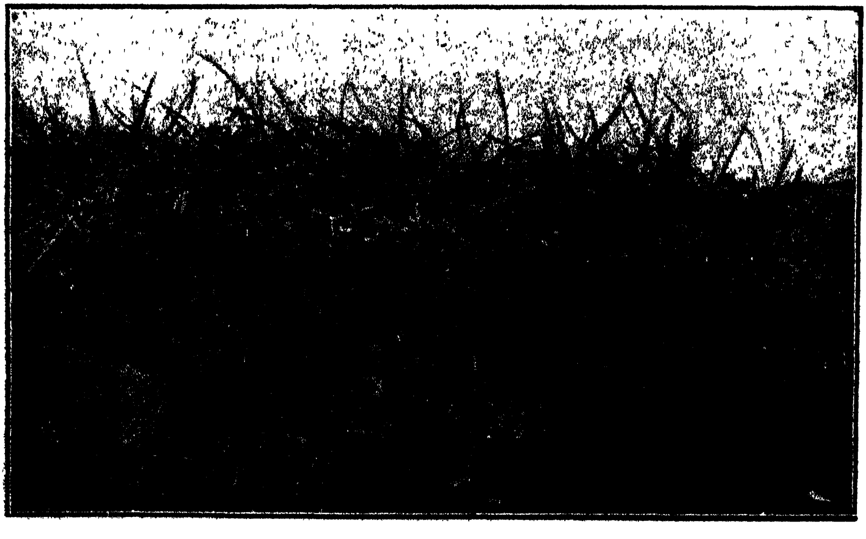

FIG. 8.—A SIDE VIEW OF TURF NO. 7 (RYE-GRASS – STRAWBERRY-CLOVER PASTURE).

Note the strong root-growth of strawberry-clover showing at the side of the turf.

Strawberry-clover is a perennial plant, is like white clover in its habit of growth, spreading over the ground by means of stolons. Like white clover also it is a twitch, and the stolons strike roots at the nodes. But, unlike white clover, it is very deep-rooting and its roots will penetrate over 20 in. into the soil. This deep-rooting habit explains its successful growth on dry or salty soils and its high summer production. The leaflets of strawberry-clover are hairless and similar in appearance to those of white clover. A distinguishing feature, however, is that they are generally long and narrow compared with white clover leaflets. The flower is very similar to the white clover flower, but the petals usually have a pinkish tinge. Later it forms the strawberry-like seed-head from which it receives its name. The seed-head is similar to the reversed clover seed-head just described.

Strawberry-clover establishes itself best in damp situations, whether from seed or transplanting. When established it grows best where the drainage is good. It will exist in drier or more salty and in wetter conditions than white clover. It demands high fertility—probably higher fertility than even white clover for vigorous growth. In the winter and in wet summers it grows less vigorously than white clover. In dry summers, however, it excels.

Strawberry-clover can be seen at Pipiroa invading territory but sparsely populated by weeds and annuals. It is a better colonizer than reversed clover, and is occupying fields poorly favoured by stocking in which reversed clover has not established, although given every opportunity to do so. The strawberry-clover at Pipiroa suffers in that it is a shy seeder. It is essentially a leaf-producer. If it was as prolific a seeder as reversed clover, there would be no depleted land now at Pipiroa. After strawberry-clover has established itself, perennial rye-grass commences to grow in its midst, and the pasture becomes a rye-grass - strawberry-clover one. Such a pasture is capable of high butterfat-production per acre, comparable to rye-grass and white clover. The rye-grass produces most of the feed in the autumn, winter, and spring, and the strawberry-clover in the summer. Strawberry-clover being a permanent clover of high production, and providing a dense cover of the ground, is similar in habit to white clover. At Pipiroa it is successfully taking the latter's place.

CAUSE OF DETERIORATED PASTURES.

By now it was fully realized that the deterioration of the pastures was caused by the death of white clover. White clover holds a key position in our high-class pastures, and if it fails the pasture-grasses suffer. A sequence of events may follow the failure of white clover such as befell the pastures at Pipiroa, leading to almost complete destruction of the sward. One is tempted to portray the probable sequence at Pipiroa because it is interesting and may serve as a basis to work on where other instances of depletion are met.

Either the soil became too salty or too dry for white clover to live. Excess of salt in the soil kills a plant by depriving it of water, and so the effect is the same as lack of moisture in the soil. White clover is perhaps the most shallow-rooted of our pasture-plants and very susceptible to dry conditions. The summer of 1928–29 being very dry, the heavy Pipiroa soil dried out to a very great extent and the white clover died out completely. The death of white clover of course left the ground more open to the action of the sun's rays and still further drying-out resulted. The rye-grass would be now in a very weak state or dead. The *Porina* caterpillar, being more common in dry climates and in sparse pastures, was apparently encouraged by the suitable conditions prevailing on the weakened pastures, and completed the destruction of the rye-grass. With no vegetation to keep the surface moist, and no live roots to hold the soil together, the ground cracked, making homes for millions of crickets, which cleared up the dead stalks of rye-grass. The result was that on 1,000 acres of land, on which all the rye-grass and white clover was destroyed, all that was left were odd plants of tall fescue, weeds, and patches of *Poa pratensis*, prairie-grass in one or two places, and one small green patch of strawberry-clover. The *Porina* caterpillar was working at the edges of the depleted land now swarming with crickets. Investigators were called in at this stage, and their confusion is perhaps understandable. If they had been able to see the progressive deterioration their job would have been a much easier one.

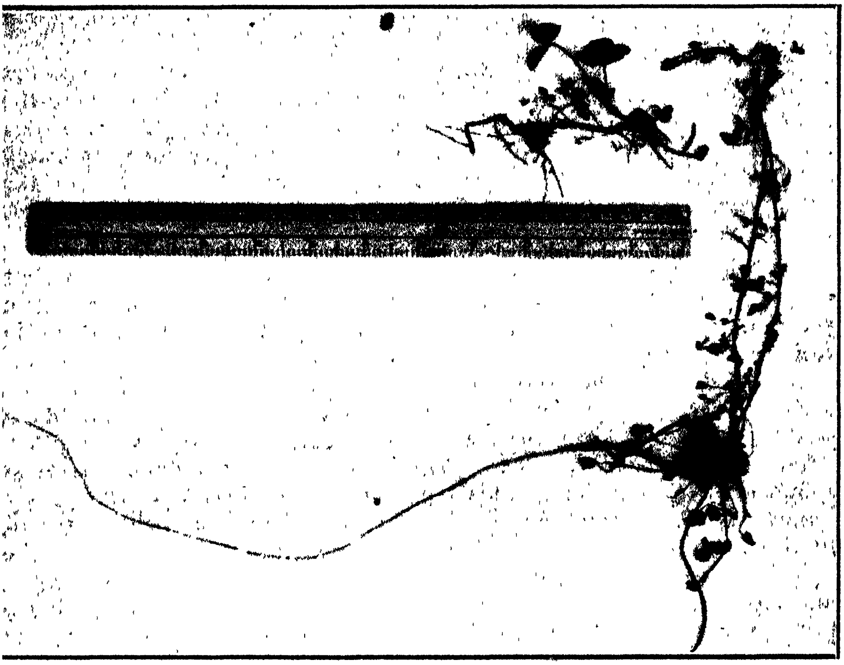

FIG. 9.—A PLANT OF STRAWBERRY-CLOVER (RIGHT) AND A PLANT OF WHITE CLOVER (LEFT) FOR COMPARISON.

Note the length of the root of the strawberry-clover and the short roots of white clover, from the stolon.

This patch of strawberry-clover finally showed that what was lacking was a thick permanent sole of clover. Conditions were too dry in many seasons in the summer for white clover, but they were not too dry or too salty for strawberry-clover Strawberry-clover well established, and the permanent rye-grass soon appears. A thick sole of rye-grass and strawberry-clover, and there is no infestation of *Porina* caterpillar, no cracking of the soil and a home for crickets. Thus what appeared a complex problem is solved.

SUCCESS IN TRANSPLANTING

The strawberry-clover is extending its range steadily. During the past eight or nine years it has covered about 20 acres of land, mainly by natural means. Every endeavour now should be made to establish this plant all over the remaining 900-odd acres to make it again highly productive One farmer at Pipiroa, Mr Scott, has been establishing strawberry-clover by transplanting it in his fields for the past three years The earliest planted area has now patches of this clover up to half a square chain in extent. At first he took great care in transplanting, and obtained fairly large sods for transplanting. Lately very small sods the size of the palm of one's hand are transplanted successfully Another farmer has obtained successful establishment with cuttings of stolons placed on the ground when it is moist and simply trodden into the soft earth or mud. The transplanted material establishes itself best in hollows, or in old watercourses where the soil is moist in the summer During the first year the transplanted strawberry-clover does not spread rapidly, and colonizes in that period about a square yard. After the first year its spread is increasingly more rapid, and it consolidates its position by thickening.

The other method of strawberry-clover establishment is by seeding. Unfortunately the type of this clover frequently obtained from purchased seed is not virile, and although useful, does not compare with the type of strawberry-clover already established at Pipiroa. The seed is also expensive. The clover establishes itself best in hollows or plough finishes, where the soil is moist over the summer. Apparently strawberry-clover before its deep-rooting system develops is less tolerant of dry conditions Yet when established, in the winter where the soil is poorly drained and wet, strawberry-clover appears unthrifty, and, as previously mentioned, it excels in dry summers.

Before establishment by seed will be advisable some research will have to be made on the productivity of strains of strawberry-clover. There is no doubt that different strains exist, and will be found to vary in yield as markedly as different strains of white clover.

There are thousands of acres of reclaimable marine flats in and around the harbours of North Auckland which are being gradually reclaimed and grassed. For the future safety and well-being of these areas, strawberry-clover should be included in the grass and clover sowings. I hope that, before many of these areas are reclaimed for grassing, investigation will have revealed areas of leafy high-yielding strawberry-clover from which supplies of seed can be obtained.

VERNALIZATION TRIALS WITH WHEAT.

R. THOMSON, Agronomy Division, Lincoln.

VERNALIZATION, devised by T. D. Lysenko (1) at the Odessa Institute of Plant Breeding, is a method involving the pre-treatment of seed to accelerate its development and induce earlier maturity. The subject has received much prominence of recent years. Writing of this method N. A. Maximov(2) says, "The extreme simplicity and yet high efficiency of this method has been demonstrated by the fact that during the current year, 1934, about one million hectares (approximately 2,500,000 acres) have been sown with vernalized seed in U.S.S.R., and yet reports of failure in carrying out vernalization are very rare, even in localities most remote from scientific centres." While reports generally from the U.S.S.R. comment favourably on the method, reports from other centres are more conflicting, varying from records of complete success to failure(3).

The technique for wheat suggested by Lysenko is briefly as follows(1): The seed is moistened with one-third of its weight of water, the water being added in several applications until all has been absorbed. The moistened grain is then spread in layers of from 9 in. to 12 in. deep and allowed to germinate. During this process the temperature should not be greater than 15° C. If it rises, the grain must be spread more thinly, and *vice versa*. When in odd grains the embryo has pierced the seed-coat the temperature is reduced to 3° to 5° C. and held at that for the required length of time. This is given as varying from twelve to fifty days according to the variety. When sowing through a drill, the seeding-rate has to be adjusted to allow for the swollen nature of the grain.

Two possible applications of the practice suggested themselves for New Zealand conditions. On certain of the heavy wheat lands, typically winter wheat country, autumn rains often so delay cultivation that autumn sowing becomes impossible. If by vernalization the growth of a winter variety could be so accelerated to allow of its being spring-sown, this difficulty would no longer exist. In other districts spring sowing following turnips is a regular practice, but often proves disappointing owing to the lateness of sowing. Hastening the maturity by vernalization suggested a method whereby this practice might be rendered more certain.

To test out these possibilities under local conditions experiments with wheat were planned and carried out at the Agronomy Division, Lincoln, during the past season. Four varieties, giving a wide range of maturity were chosen—Hunters and Velvet, both winter wheats; Jumbuck, a spring wheat; and Solid Straw Tuscan, a variety which can be sown with success in either autumn or spring. Lysenko's technique as described above was followed. The moistened grain was germinated in shallow trays and then placed in a refrigerator at 3° to 5° C. for periods of eleven, eighteen, and twenty-five days. These were so timed that all the seed was ready for sowing on the same day. Sowing took place on 7th October. Each treatment was repeated five times for each variety, and untreated controls were included in all plots. There were no significant differences in germination between the treatments or between the treatments and the controls. In all cases, however, the untreated seed was a day later in coming through the ground.

The relative maturity of the treatments, as indicated by heading dates, is given in Tables I and II for spring and winter wheats respectively.

Table I.—Spring Wheats.

—	Jumbuck		Solid-straw Tuscan	
	Date Headed	Days Earlier than Control	Date Headed	Days Earlier than Control
Control unvernalized ..	27th Dec.	..	7th Jan.	..
Eleven days vernalization ..	25th Dec.	2	5th Jan.	2
Eighteen days vernalization ..	23rd Dec.	4	5th Jan.	3
Twenty-five days vernalization	23rd Dec.	4	4th Jan.	3

From the above table it will be seen that both varieties showed a slight acceleration in heading. Threshing-weights revealed no differences as the result of any of the treatments. Grain samples from each of the treatments were similar, those of Jumbuck being very well developed, while those of Solid-straw Tuscan were slightly pinched.

Table II.—Winter Wheats.

In the winter wheats Velvet and Hunters retained their winter habit into February. A count was made on 12th February, when earing was as follows:—

—	Velvet	Hunters
	Per Cent.	Per Cent.
Control unvernalized	..	2·4
Eleven days vernalization	4·8	5·9
Eighteen days vernalization	8·8	11·2
Twenty-five days vernalization	14·7	18·1

These ears set grain, which, when the experiment was finally examined on 8th March, was in the milky stage.

Further ears continued to appear. These late ears were small and short and mostly empty, although some contained very immature grain. A final count of the total plants in ear was made on 8th March. These figures are given in the following table:—

Table III.

—	Velvet.			Hunters.		
	In Ear.	Shot Blade.	Winter Habit.	In Ear.	Shot Blade.	Winter Habit.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Control unvernalized ..	4·0	61·4	34·6	13·6	86·4	..
Eleven days vernalization ..	13·9	75·5	10·6	26·5	73·5	..
Eighteen days vernalization ..	25·3	68·1	6·6	39·5	60·5	..
Twenty-five days vernalization	33·9	61·0	5·1	51·2	48·8	..

SUMMARY.

(1) Vernalization accelerated the earing of spring wheats such as Jumbuck and Solid-straw Tuscan, but the degree of acceleration was slight and insufficient to be of any practical significance under New Zealand conditions.

(2) When winter wheats such as Hunters and Velvet were vernalized and spring sown, the treatment induced a very much higher proportion of ears to develop, but in no case did they reach maturity. Even so, earing was forty-seven days later than untreated Jumbuck.

(3) The percentage of earing progressed with increased lengths of treatment, and it is probable that an even longer period would still further accelerate development.

(4) From these trials vernalization does not appear to have any place in commercial wheatgrowing in New Zealand. Satisfactory spring varieties are already in existence, and in any case the long period of treatment that is necessary would render the practice uneconomical.

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(2) MAXIMOV, N. A.: The Theoretical Significance of Vernalization. Bulletin No. 16, Herbage Publication Series, Imperial Bureau of Plant Genetics; 1934.

(3) Vernalization and Phasic Development of Plants. Bulletin No. 17, Imperial Bureau of Plant Genetics, 1935.

NEW TREE FOR FARM SHELTER.

I. D. BLAIR, Canterbury Agricultural College

IT is generally admitted that the most useful and desirable type of medium-high shelter is that obtained by growing a combination of rows of *Pinus radiata* and *Cupressus lawsoniana*. Usually two to four rows of pines are planted, with the trees 6 ft. to 8 ft. apart each way, and with one row of *Cupressus lawsoniana* (or *Cupressus Benthamii*) planted 12 ft. to 15 ft. from the pines, with the *Cupressus* trees 4 ft. to 6 ft. apart within the row.

The value of this combination of trees is that the pines are able to provide the high shelter and the lower-growing *lawsonianas* form a dense low line which overcomes the ill effects of the openness between the trunks of the mature pines. Winds which rush through the bare trunks of pines which have lost the lower branches or which have no dense low shelter on one side are probably as severe as where there is no tree-shelter whatever. For low shelter in odd corners or along part of one side of a field *lawsonianas* alone may well be grown in double rows. Such shelter-belts are a feature of many parts of Waikato and are a tremendous asset to those who have been successful in establishing this combination of pines and *lawsonianas* or *lawsonianas* alone.

Throughout the South Island reports are received that it has been impossible to establish belts of *Cupressus lawsoniana*, except on the very best land in the warmer localities of a few districts. To get them to grow at all on the Plains areas one has at least to dig holes and fill these with good soil, in which the *lawsonianas* can then be planted Even then these trees do not grow well as they approach maturity.

A SPECIMEN OF CUPRESSUS ARIZONICA GROWING AT CANBERRA IT IS TWENTY YEARS OLD AND ABOUT 25 FT HIGH, GROWING UNDER CONDITIONS OF A 20 IN RAINFALL

All over the Canterbury Plains one can find lines of various species of pines which are quite open at the ground and which thus fail to provide effective stock-shelter. The problem is to find a tree which will grow in association with pines and provide ground shelter in the same manner as *Cupressus lawsoniana* does in Waikato, Taranaki, and Manawatu. *Cupressus macrocarpa* has been recommended for this purpose, but the results, particularly on the drier areas, have not been promising. The branches of *Macrocarpa* grow upright, and unless a trimmed hedge is maintained this tree fails to provide the low shelter.

At Canterbury Agricultural College Professor E. R. Hudson has introduced a new species of cypress which is likely to fulfil the requirements of South Island dry conditions. This valuable addition to our farm-shelter trees is *Cupressus arizonica*, the Arizonian Cypress, the seed of which has been introduced from Canberra.

THE FEATURES OF CUPRESSUS ARIZONICA.

The following is an extract from a letter received from Mr. A. E. Bruce, Superintendent, Parks and Gardens Section, Department of the Interior, Canberra :—

" With regard to the qualities of *Cupressus arizonica* as a farm shelter-tree, I should say they were perfect. Its hardiness is unequalled in heat or cold, in dry or wet. There is no other species of Cypress which surpasses it in these respects. Its soil requirements are very easily satisfied, provided good preparation is given to the ground and the position in which it is to be planted. It will withstand any amount of trimming back. We have miles of it used as hedges, kept at a height of 2 ft. 6 in. by 1 ft. 6 in. to 2 ft. wide. The economic value of the tree I cannot comment upon, beyond the fact that its growth here is nearly equal to that of *Pinus radiata*, and I feel sure that the timber is much better in quality than that of *Pinus radiata*—close-grained and very tough. I am of the opinion that you cannot go wrong with *Arizonica* as a shelter-tree, and I believe its growth would be much better with you than with us in our area of 21 in. rainfall."

In the *Agricultural Gazette* of New South Wales, January, 1930, there is the following comment on *Cupressus arizonica* :—

" This species has not been grown to any great extent in this State, but is one of the most widely planted of the Cypresses in South Africa—used for hedges, breaks, and shelter-trees. It does well on a wide range of soils. The lateral branches have a fairly wide spread and provide excellent shelter, a single row being very effective as a windbreak."

It is believed that this tree will prove most useful under South Island conditions. It is certainly worthy of extensive planting under the conditions in which *Lawsoniana* and *Macrocarpa* have failed.

The accompanying photograph of a twenty-year-old specimen of *Cupressus arizonica*, which is 20 ft. high, illustrates clearly the dense, low shelter obtained, the type of shelter which is needed most urgently all over the Plains areas of the South Island.

On a farm in the Ruawai district the value of certified rye-grass is well exemplified. In two fields alongside each other a pasture mixture was sown down four years ago. One was sown with certified rye-grass in the mixture, the other with Canterbury seed, non-certified. The two fields have received practically the same treatment. The paddock in which the certified rye-grass was sown now possesses the desirable rye-grass-white-clover pasture, with sufficient but not too much paspalum. The other possesses little rye-grass, is paspalum-dominant, which grows rank and is inclined to smother the white clover. Thus it appears that on such alluvial clay soils, to obtain that essential type of pasture so desirable and also so highly productive in North Auckland, certified rye-grass must be used.

BLACK-CURRANT-BUD EELWORM IN NEW ZEALAND.

J. MUGGERIDGE and W. COTTIER, Plant Research Bureau

IN the spring of 1933 a few cuttings from black-currant bushes were received at this laboratory from the Orchard Instructor at Masterton. These were suspected of being infested by the mite *Eriophyes ribis*, which in other parts of the world causes "big-bud" in these plants, the typical condition being an abnormal size in the terminal buds of shoots. A close examination of these buds showed, however, that they were infested by eelworms, in some cases very heavily. In subsequent cuttings received we were unable to find eelworms, and there was a further suggestion that the trouble was caused by Eriophyid mites. Material was sent to England in 1935, but it arrived in too dried up a condition for accurate diagnosis. More specimens received at the laboratory in the early part of 1937 proved again to be heavily infested by eelworms, the symptoms strongly suggesting that the cause of the trouble was the eelworm *Aphelenchoides ribes* Taylor, a pest of black-currant buds hitherto recorded from Britain only, where it was first found in 1917. Material again sent to England was examined by Dr. Goodey, of the Imperial Institute of Agricultural Parasitology, and he found the eelworms present in the buds, in some cases in large numbers. In all cases they proved to be the black-currant-bud eelworm (*Aphelenchoides ribes* Taylor). We have also received specimens of this eelworm on black-currant cuttings from Hastings, Hawke's Bay, but we are unable to say how widespread this pest is in other parts of the Dominion.

SYMPTOMS OF ATTACK.

The presence of infested buds has a great influence on the growth of the wood buds, especially in the spring and early summer. The general effect is to produce a very uneven type of growth, healthy shoots alternating with dead buds (Fig. 1). If infested buds be cut open they will be found to show a more or less extensive black discoloration in the centres.

Taylor (1917) accurately describes the diseased condition as follows:—

"If . . . a shoot known to be infected with worms is kept under observation in the spring, it is seen that the wood buds which have escaped attack will push into growth. These shoots, proceeding as they do from centres of infection, may grow a few inches and then suddenly wilt and die, owing to the worms piercing the delicate tissues of the young stem and destroying the developing leaves. The concentration of the sap in the unattacked buds below such an abortive shoot usually causes several of the nearest unattacked buds on the old wood to break into shoots. These may, if growth is being rapidly made, attain to the length of from 6 in. to a foot. Upon examination of the minute buds they bear it will be found that few have escaped attack . . .

"The terminal buds on such infected shoots are invariably killed, as are many of those immediately below. If all the buds at the apex of those new shoots are successively attacked (and such is a frequent occurrence) the shoot dies back to the nearest unattacked bud. The new basal wood, which considerably influences the yield of fruit in black currants, is similarly attacked and destroyed.

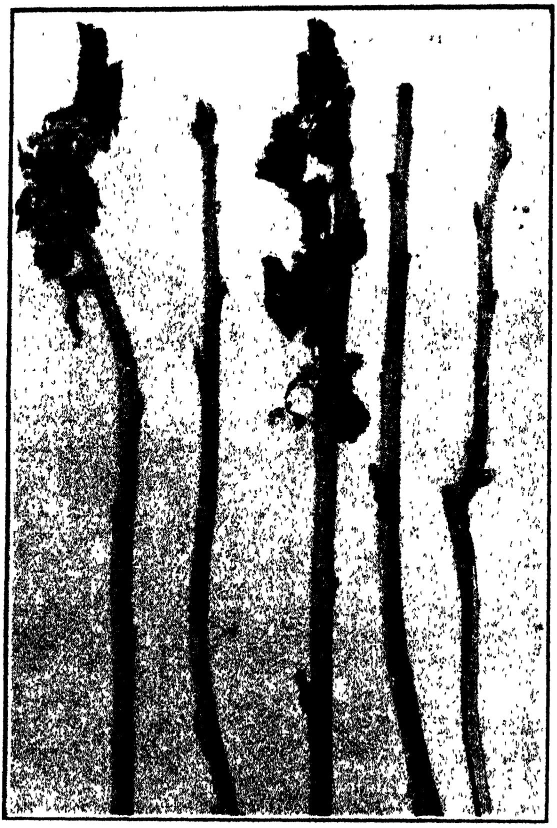

FIG. 1. SHOWING TYPE OF GROWTH CAUSED BY EELWORM INFESTATION NOTE THAT SOME BUDS HAVE PRODUCED LEAFY SHOOTS, WHILE OTHERS HAVE FAILED TO DEVELOP. NUMBERS OF THESE LATTER HAVE WITHERED AWAY.

[*Photo by H. Drake.*

"Repeated efforts are thus being made by the tree during the growing season to produce new wood, with the result that an irregular growth of twigs is produced about a diseased area. During the resting season no alteration takes place in the growth of the tree, but the worms continue to destroy the buds. In the spring long lines of unexpanding buds, interspersed with a few which are developing normally, show the effect of the activity of the worms during the months when the trees remain dormant.

"The irregularity in the growth of the wood is most characteristic of an eelworm attack, and the presence of dead or partially dead shoots, with the bark shrivelled, the end tapering and thread-like, together with a cluster of weak shoots, are typical signs of the presence of the black-currant eelworm."

THE CAUSAL ORGANISM AND ITS HABITS.

The eelworms are very minute in size, not discernible as such to the naked eye, and their true nature can be made out only under magnification. When infested material is teased up with water and viewed through the microscope the colourless and more or less transparent worms appear as in Fig. 2. When adult the worms are approximately 1 mm long In infested buds all stages from the egg up to the fully-grown adult are present.

According to Taylor (*loc. cit.*) the worms enter the buds through the spaces between the scale-leaves. They either remain feeding amongst the scale-leaves or else pass on to the inner and true leaves. In the first case, the scale-leaves themselves being more or less unattractive for feeding, the eelworms congregate at the base of them and feed on the succulent tissue there. The damage done to these parts results in the decay of this tissue and the water and food supply being thus cut off from the buds these structures die and decay, the worms subsequently multiplying in the decaying material. When the true inner leaves of the bud are attacked the tissues there are discoloured and finally destroyed. The eelworms do not feed internally in the tissues of the bud-leaves, but live ectoparasitically between them.

When a bud has been destroyed the worms migrate to adjacent buds either above or below the one they have left. For this they require the presence of films of moisture on the stems, and migration is entirely dependent on the presence of such conditions produced by rain, dew, &c. Having reached healthy buds the worms quickly set to work to destroy them in turn.

The time taken to destroy buds varies with the state of growth these are in. In the spring, when the new buds are very small, they are killed rapidly, but later on when the buds are freely developed they can remain alive much longer.

The worms are at work in buds all the year round, but in the springtime they seem to be most active, and this is the time of the year when most reproduction is going on.

Under dry conditions the worms can exist in a dessicated but live state for several months, so that in cases where they have killed buds and are ready to migrate, but are unable to do so on account of the dry state of the bushes, they will assume this dessicated resting condition. As soon as sufficient moisture is present they will revive, however, and take on active movement again and are quite able to migrate to adjacent buds and multiply there.

DISPERSION.

The eelworm can be disseminated by striking cuttings containing infested buds and very probably by the handling of healthy bushes and infested ones in turn, such as is bound to occur in pruning operations. This dissemination would be much more effective if the bushes were handled or pruned when they are moist. Heavy rains can wash or splash migrating worms from one stem to another or on to the ground whence they can crawl in the moisture films to other bushes. When the worms are in a dessicated state washing off by rain and splashing to adjacent parts is all the more easy, as in the dried condition they float very easily on the surface of the water. It is also suggested that wind may play a part in spreading worms, as in dry weather dead buds dry up rapidly and the scale-leaves quickly become brittle and are broken off and carried away by the slightest movement, taking with them colonies of dessicated worms in a quiescent condition.

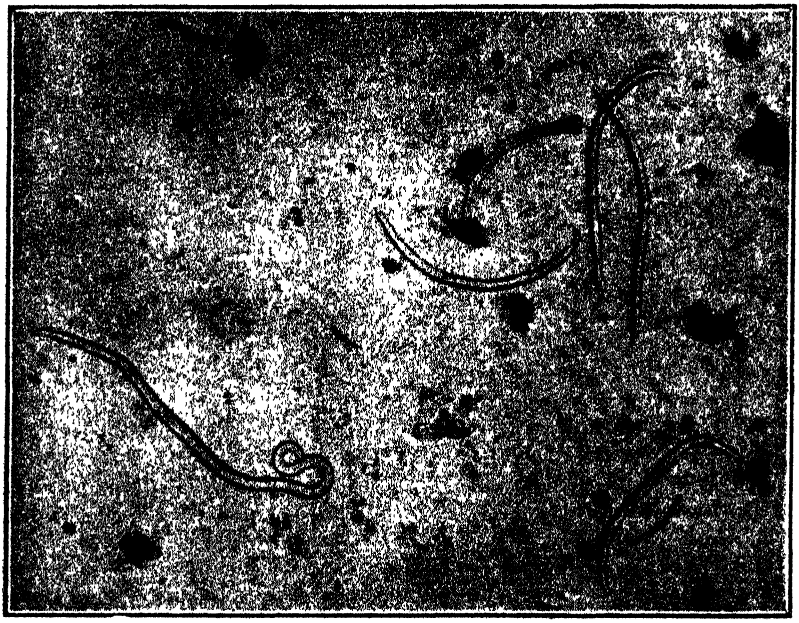

FIG. 2. PHOTOGRAPH THROUGH THE MICROSCOPE SHOWING TYPICAL INDIVIDUALS OF THE BLACK-CURRANT EELWORM. X 70 (APPROX.).

CONTROL.

As far as the writers are aware, no work has been done on the control of this particular pest in any part of the world. Recent correspondence with the Imperial Institute of Agricultural Parasitology in England has shown that English authorities agree that possible remedies can only be suggested and that nothing positive can be asserted. It would seem that possible means of control might be along the following lines, and this is all that can be put forward to growers at the present time :—

(1) The use of sprays and chemical dips.
(2) Hot-water treatment of one- to two-year-old plants in the nursery before placing out in permanent beds.
(3) General hygienic measures.

The above methods are suggested from a consideration of those measures that have been adopted for closely related plant parasitic eelworms—*e.g.*, the chrysanthemum eelworm (*Aphelenchoides ritzema-bosi*). There seems no reason to suppose, provided the worms can be reached, that the black-currant-bud eelworm cannot be killed by treatments that control such closely related species.

(1) *Use of Sprays and Chemical Dips.*—Sprays at best have been found to be a doubtful quantity and only partially successful against this type of eelworm. Goodey (1933), in discussing the position with regard to chrysanthemum eelworm, states that a thorough investigation of spraying-materials tried has shown that most of them are useless. This is the case with sulphur and copper compounds, potassium permanganate (Condy's crystals), barium chloride, picric acid, sodium carbonate, limewater, mercury, arsenic, and nicotine preparations in soft-soap solutions at concentrations harmless to the plant. The only material which might offer some promise of success is a 3-per-cent. solution of ammonia. This has been used by some workers on chrysanthemums without injuring the plants, and favourable results have been claimed in killing the worms. The difficulty with spraying for black-currant-bud eelworm will be to reach the worms that are hidden between the bud-leaves. It seems that the best that can be hoped for is a kill of those worms that are caught in the act of migrating from one bud to another, and this will provide relief but not cure. It is suggested that those who might wish to try a spray would be well advised to try the ammonia solution, using ordinary ammonia 3 parts to 100 parts of water. At first use the spray carefully on a few bushes only, as it is not known what the effect of the spray on black currants will be. It can be readily understood that frequent sprayings at regular intervals will be required, as the idea is to catch the worms as they are migrating.

Since this migration is going on at all times, spraying will theoretically bea dvisable throughout the year, but the most important period will be in the spring, when the bushes are beginning to shoot.

Miles (1935) says that in certain quarters it is claimed that dipping chrysanthemum-cuttings in a potassium-sulphocarbonate solution will rid them of eelworms. However, it is not yet accepted as a proved case, but if the chemical will kill chrysanthemum eelworms where the worms are actually within the tissue, it is considered reasonable to suppose that it will also kill black-currant eelworms where the worms live between the bud-leaves and not actually within the plant-tissue. It may be worth while to try dipping black-currant cuttings in the solution prior to striking. The dip is prepared by dissolving ½ lb. potassium sulphocarbonate in 3 gallons of water in which ½ lb. of soft soap has been dissolved. Soak the cutting in this for one hour.

(2) *Hot-water Treatment.*—This method is drastic on most kinds of plants and could be tried, of course, only on young black currants before they are put out into permanent beds. In all likelihood hot-water treatment of unrooted cuttings would result in the death of all cuttings treated, and it is necessary that they should have been struck and grown a strong root system before being immersed

in the hot water. After a consideration of the available information it would seem that only young plants one or two years old could be submitted to hot water at a temperature of 110°–112° F. for thirty minutes. Do not immerse the roots, and to prevent their drying out wrap them in damp cloth. For success it is necessary to keep the temperature constant within the limits set, and to do this without a thermostatically controlled bath might be laborious, especially considering that the volume of warm water might be necessarily fairly large. To keep down the volume of water it would be advisable to prune back the young bushes as hard as possible before treatment. To carry out the treatment successfully it is necessary that the thermometer used should be accurate and the source of heat must be such that it can be controlled satisfactorily. If young bushes with strong rooting-systems are used, pruned back and with their branches tied in a bunch to conserve space, it should be possible to carry out the treatment with reasonable efficiency. Hot water is very effective in killing eelworms, and although it is usually drastic on plants one can be satisfied that if the treatment is carried out properly there is little chance of survival of the pest. Treatment must be carried out in the dormant season. No experimental work has been carried out to discover the effect of hot water on the subsequent growth of black-currant plants, and growers are advised to proceed cautiously until something more definite can be put forward.

(3) *General Hygienic Measures.*—On established plants in permanent positions in black-currant beds it seems that little can be done beyond cutting out and burning all infested parts and periodically spraying with the ammonia solution described above, if such should prove suitable for application to black currants. A careful watch should be kept at all seasons of the year for signs of eelworm attack, and all shoots bearing any signs of weak or dead buds or any other suspicious symptoms should be carefully removed and burnt. Especially in the spring is it necessary to keep a careful watch, and all branches bearing weak and spindly growth from buds should be promptly cut out. Handling of any kind such as is necessary in pruning should not be done unless the bushes are dry If such operations are carried out under moist conditions it can readily be understood from what has gone before how easy it would be to transfer worms from one shoot to another or from one bush to another. Do not leave prunings on the ground, as worms can migrate from these to adjacent healthy growth, especially to underground shoots. Gather up all cut pieces and destroy them. When putting out new plants be careful to place them well away from infested bushes.

Hygiene demands the avoidance of indiscriminate handling at all times, and these measures and the cutting-out of all suspected growth will help greatly to check the spread of the eelworm.

ACKNOWLEDGMENTS.

The writers are indebted to the Imperial Institute of Agricultural Parasitology in England for the identification of the black-currant-bud eelworm and also for various suggestions on possible control methods.

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PREVENTION OF FROST DAMAGE IN ORCHARDS.

VISIT TO WESTERN STATES OF AMERICA.

W. R. LLOYD WILLIAMS, Orchard Instructor, Alexandra

IT may safely be stated that preventive measures against frost damage with fuel oil as the heating medium were commenced commercially in New Zealand orchards as a result of the destructive spring frosts of 1926 in Central Otago. The writer, arriving in the district a few days after the visitation, was convinced that it was one of the major problems Contacts were immediately made with authorities in California, notably Mr W. R. Schoonover, with whom an intermittent correspondence has since been carried on, with great benefit to the industry here. The deciding factor to growers was the initiation of an experiment in orchard-heating financed by the Department of Agriculture. The experiment was conducted by the writer with lard-pail heaters burning oil at the orchard of Mr W Bringans during the springs of 1927 and 1928. Annually the area protected in Central Otago was slowly but steadily increased until 1933, when another disastrous frost occurred, after which the area protected was increased more rapidly.

Last spring, 1936, certain areas in Central Otago were again considerably damaged and, in addition, injury was caused over a large area in Hawke's Bay As a result of these all-too-frequent occurrences a large number of growers who had not previously used protective measures desired to acquire equipment, but before incurring the expenditure that this would entail, an expenditure which many growers in consequence of their periodically reduced crops and low fruit prices could ill afford, it was felt that the industry should be in possession of the latest information on the subject. To this end the Government was asked to allow a departmental officer to visit the Western States of America and investigate the methods employed in this connection. As a result I was deputed to proceed to Oregon and California, via Vancouver, leaving Auckland on 20th April " for the purpose of investigating the latest methods adopted in that country by way of protecting fruit crops, particularly deciduous fruit, against frost damage." As it was considered necessary to bring back the information in time for the coming season's danger period, the visit was limited to a return to New Zealand by the end of June.

Time was spent with officials and growers in the deciduous orchards of Medford (Oregon), Wenatchee and Yakima (Washington), and Southern California, also the citrus-groves of the latter State, and contacts were made with the leading authorities on frost-prevention work, including those of the Departments of Agriculture and at the California University and its experiment stations at Riverside and Davis.

There is no doubt that frost-prevention is a very important factor in orchard-management in certain fruitgrowing areas, and it is equally true that where standard methods have been efficiently applied a satisfactory measure of success has been achieved.

TWO MAIN PRINCIPLES.

The two main principles involved in frost-prevention are (*a*) prevention of heat-losses and (*b*) addition of heat. The former method is practised to a limited extent in the form of screens of various sorts, such as scrim, paper, &c., soiling-up of low-grown crops, and water vapour. Smoke, including chemical smoke or screens as used in the war, has been proved of no value except for the very lightest frosts. Glasshouses are a good example of the prevention of heat-losses.

In orchards the most popular methods are by adding heat in some form or another. Undoubtedly the fuel in most general use for orchard heating, whether for deciduous or citrus, is a marine Diesel oil, similar to that in use in New Zealand, but somewhat more refined. The "lard-pail" type, or "smudge-pot" as it is generally called, is the most generally used oil-burner for deciduous fruits. It is emphasized by the best authorities that, except for the smoke and soot nuisance, these heaters give as satisfactory, and usually cheaper, results for oil-burning as any on the market, including the much higher-priced types. Larger pots are mostly used without flame spreaders and they are spaced farther apart than in New Zealand. This method certainly reduces labour, but the writer was advised that our method was safer under our conditions, especially if the inversion is poor, as is often the case on the first night of a series of frosts.

More expensive equipment, such as high and low stack heaters, and those fed through piping reticulated through the orchard from a central storage tank, are only used in deciduous orchards to a limited extent. Millions are in use in the citrus groves on account of the longer burns necessary in winter time and, when properly used, of their almost complete smokelessness.

Solid fuels are also used with success in some orchards, the favourite being petroleum-coke, a production of gasoline "cracking" plants. Considerable improvements have recently been made in solid-fuel heaters, improved draught is available and fires can be extinguished by a device which excludes the air.

Other methods of orchard-heating were also investigated.

ELECTRICITY IMPRACTICABLE.

Electric heating is entirely impracticable on account of the enormous amount of electricity required to heat even a small orchard.

Air-circulators, or wind-machines, with large propellers for mixing the upper warm air with the lower cold air, and later models with furnaces burning oil attached, were seen.

A liquid-petroleum gas piped throughout the orchard from a reservoir burns a propane-butane combination.

An example of central heating of orchards with hot air was investigated. It consists of two small brick furnaces which are supplied with a mixture of oil and air through burners on the side. Fans draw off the heated air and discharge it into two mains, which feed cross laterals along each row. In these laterals are holes for the warm air to circulate through the trees. The outfit has proved successful over a number of years.

Thermometers and frost alarms were looked into and the degree of damage done at different temperatures at varying stages of growth. Considerable work has been done by officers of the United States Weather Bureau in this connection, and until we create our own table of damaging temperatures we must avail ourselves of their figures as a basis. Much, however, needs to be done to co-ordinate these temperatures with our own. the first step being to improve and standardize the type of thermometer shelters in use in New Zealand orchards.

Up to the abnormal frosts of January, 1937, in the citrus areas of California, it may be said that for a number of years the principal avenue for official research energy and money into frost-prevention methods was in the direction of improving the types of oil-burners, in obtaining greater heat, in improving combustion, and, as a result, combating the smoke nuisance—the latter especially appearing to be the main goal. Much has been done in this direction ; new and better types of burners have been evolved and improvements made to old ones, resulting in an appreciable lessening of the smoke nuisance. Consider the extent of the oil industry, the cheapness of this fuel, and its comparative ease of transport and use, the capital sunk into plant established for the manufacture of the present type of burner and into the millions of these oil-burners in stock in the orchards, and it can be appreciated why research has not materially extended into wider fields. Great work has been done in this connection by the Engineering Branch of the Davis Experiment Station of the University of California in conjunction with Mr. Schoonover and others. Intensive research is now taking place into new methods. The first big preliminary move is a complete survey of orchard-heater performance by means of answers to a comprehensive questionnaire taken by officers from every person using frost-prevention appliances.

It is impossible to estimate the value of the services of the small band of specially trained United States Weather Bureau men, under Mr. Floyd D. Young, who constitute the Fruit Frost Service. Men are stationed in various districts during the danger period and broadcast the necessary information. Growers depend wholly on these forecasts for orchard heating.

SUMMARY.

Smoke is of no practical value for frost-prevention.

Water is of use only in light frosts and in cases of emergency.

Electricity is too expensive.

Air-circulation has not proved satisfactory, and is very costly. Newer types, which will be still more costly, are being tried.

Lard-pail oil-heaters are still equal to any other type for deciduous fruits.

Tall stack oil-heaters are too expensive for our use.

Low stack oil-heaters will eliminate the smoke nuisance at a reasonable cost.

Liquid petroleum-gas (propane-butane) is too costly to install and maintain in this country—supplies are not dependable and the material very inflammable.

Hot air (central heating) has proved satisfactory in the one instance investigated. It is costly to install, but very cheap and clean to run.

Coal, coke, wood, &c., are used in cases of emergency only.

Carbon briquettes are not much used. Supply not dependable.

Petroleum coke briquettes are the most satisfactory solid fuel.

Coal briquettes, if used with proper heaters, should prove quite satisfactory, and if the prices of heaters and briquettes are reasonable will probably prove cheaper than oil. Also makes use of a New Zealand product. With a view to obtaining a more complete combustion the use of nitrate of soda or similar agent in the manufacture of bricketts such as is being experimented with elsewhere should be worthy of a trial in New Zealand.

Thermometers and alarms must be tested and be accurate to a half degree.

Thermometer shelters of a more standard type are required. Research into damaging temperatures is needed.

This opportunity is taken to sincerely acknowledge the really extraordinary assistance given by all with whom contact was made. This is especially true of all officers of the Departments of Agriculture and Universities of the States visited, United States Extension officers, and Fruit Frost Service men. Nothing appeared to be too much trouble, no distance too far to travel, no information too hard to obtain, to make the results of the visit successful.

SUGAR BEET AS A PIG FEED.

A crop of sugar beet grown on the Waimate West Demonstration Farm for the purpose of beet-sugar investigation is creating interest as a feed for pigs.

It is the usual farm practice to winter store pigs in open, small, grass paddock runs, with a ration of mangels, carrots, and whey.

This year, however, root-growing is confined to the above area of sugar beet, with the exception of a very small area of carrots.

A start was made in feeding sugar beet to the pigs during May last, and although at the commencement a few carrots were fed out with the beet the pigs selected and ate the sugar beet prior to the carrots

The Manager states that the pigs are particularly partial to sugar beet, and he has never had pigs to winter and thrive so well. A total of twenty-two store pigs and one sow with a litter of nine are being regularly fed with sugar beet. The total amount fed in conjunction with whey is from 65 lb. to 75 lb. per day, and the grass run area is approximately 1½ acres

The beet is lifted, leaves topped, and allowed to ripen some ten days prior to feeding.

Experience to date is such that sugar beet presents possibilities as a valuable pig feed.

—*J. E. Davies, Hawera.*

A combination of subterranean clover and swedes was noted in the Apiti district. The growth of the clover was very strong, making a dense cover between the rows, even though suffering slightly from some of the exceptionally heavy frosts experienced in the district. The subterranean clover was sown in mistake for chou-moellier seed, and the evidence noted from the mistake makes it appear as if it might be a combination worth consideration.

INVESTIGATION OF THE RELIABILITY OF THE "PICRIC-ACID TEST" FOR DISTINGUISHING STRAINS OF WHITE CLOVER IN NEW ZEALAND.

N. R. Foy, Seed Analyst, and E. O. C. Hyde, Assistant Seed Analyst

It is a matter of common observation that the individuals comprising a species, while showing a necessary degree of conformity to the specific type, display many inherent variations. Because of this variability it is possible by intelligent selection to obtain the more valuable strains from a useful species. This selection of superior strains has been carried out with great thoroughness with many species of plants, but it is only of recent years that the work has been undertaken in a systematic manner with our pasture plants.

Trifolium repens, or white clover, the most important leguminous species in our pastures, has proved a very profitable subject for this work of strain-selection. Davies and Levy(2) have made a study of this species in New Zealand, separating local strains and comparing them with others from Europe.

The characteristics to which attention was mainly devoted were :—

(1) Capacity for herbage production
(2) Seasonal fluctuations in herbage production.
(3) Ability to persist under grazing and competition with other pasture plants

On the basis of variation in these properties it was found possible to group the different forms of white clover under six types, the occurrence and uses of which they have described.

Davies and Levy report that the best New Zealand strains are excellent in all respects for permanent pasture of fertile land. The capacity for herbage-production is high, and production is maintained at a relatively high level during the critical periods in summer and winter. Plants of these strains are also well adapted to survive and produce herbage abundantly in mixed pastures of vigorous growth.

The poorer strains have a relatively low capacity for herbage-production. They show great seasonal fluctuations in production, there being little growth in late summer and winter Furthermore, these strains of white clover are incapable of persisting in a pasture where there is little opportunity for regeneration from seed.

After making an intensive survey Davies and Levy reported that in about one-tenth of the white-clover-seed crop of New Zealand the best strains were found to preponderate. Six-tenths of the crop was of a poor strain, but little better than the bulk of the European seed imported into New Zealand. In about three-tenths there was an admixture of good and inferior strains.

A need was felt for some reliable means whereby the strain represented in a line of white-clover seed might be rapidly determined. Work was undertaken by the Department of Agriculture with a view to solving the problem. The present article records the results of an investigation by the Seed-testing Station of the possibilities of a chemical test for distinguishing the strains of white clover at an early seedling stage.

REVIEW OF LITERATURE.

It has long been known that the tissues of some plants contain small quantities of a glucoside which, under certain conditions, as when the tissue is crushed, is broken down by associated enzymes, one of the products of this decomposition being hydrocyanic acid gas or prussic acid (HCN.)

The presence of a cyanogenetic glucoside in wild white clover was first reported by Mirande(5) in 1912. The occurrence of the glucoside in white-clover plants of various origin was investigated more fully by Pethybridge(6) using Guinard's test for detecting the evolution of HCN from seedlings. It was found that seedlings of the strain " Kentish wild white clover " invariably gave a positive reaction, while most samples of ordinary cultivated white clover of English origin gave a negative result. Sampson(7), using the same technique as Pethybridge, found that of fourteen samples of New Zealand seed, all produced cyanaphoric seedlings.

Doak(3) in 1933 reported the results of a very thorough investigation of the occurrence of the cyanogenetic glucoside in New Zealand white clover. Quantitative determinations were made of the amount of HCN present in herbage from plots and from individual plants. It was shown that the HCN content of herbage from plots established from different lots of New Zealand seed varied over a wide range—namely, from 10 parts per million to 130 parts per million. Furthermore, it was shown that there existed a high measure of correlation between HCN content and strain. Plots classed as " mother seed " showed a hydrocyanic-acid content of 70 to 130 parts per million ; plots classed as " permanent pasture," 30 to 70 parts per million ; rejected plots, 10 to 30 parts per million.

MATERIAL.

The seed used in the present investigation comprised some seven hundred samples which had been used by the Agrostologist to establish plots for strain trials. The seed was all of New Zealand origin, and each sample was representative of the crop from a single known field. Since most of the samples came from old pastures and had been submitted for plot trial to determine whether the seed was eligible for certification, the material was, on the whole, above average quality.

METHODS.

In the present studies the technique described by Pethybridge(6) was employed with minor modifications. Seedlings were prepared for the test by growing them from seed for eight days in diffused daylight in an incubator of the Copenhagen type. Into each of four small test tubes fifty seedlings were lightly crushed. Two or three drops of toluene were then added to kill the tissues and prevent decay. Into each tube was then suspended a strip of filter paper 2½ in. long by ¼ in. wide. To prepare this paper sheets of filter-paper were dipped into a solution of 1 part of picric acid and 10 parts of anhydrous sodium carbonate in 200 parts of distilled water. The paper was then cut into strips and was stored and used in a moist condition. The tubes were sealed with rubber stoppers, numbered, and placed in an incubator at 30° C. for forty-eight hours. If present, the cyanogenetic glucoside is hydrolysed under the influence of the appropriate enzymes, and the gaseous hydrocyanic acid is liberated. This gas, reacting chemically with the substances in the filter paper, forms a compound which gives the paper a reddish-brown colour. In this way the presence of quantities of hydrocyanic acid may be detected. The intensity of the coloration of the paper depends on the amount of hydrocyanic acid liberated, and thus it is possible to determine colorometrically the relative amounts of hydrocyanic acid produced by different samples. An arbitrary scale of colour shades was established which divided the material examined into seven groups. The colour shade at the points dividing the groups were fixed by preparing a series of colour standards.

Several series of experimental tests were conducted to determine what factors might be capable of causing variation in the intensity of the reaction. It was observed that the temperature at which the tubes were incubated was a matter of importance. The greatest intensity of reaction was produced by incubation for forty-eight hours at 30° C. At room temperature the coloration of the paper was distinctly lighter, while at a temperature of 10° C. only a faint reaction was obtained after prolonged incubation of highly cyanophoric material. The moistness of the paper strips was also found to be important. If the paper was too dry the intensity of the reaction was reduced. On the other hand, moderate wilting of the seedlings and also the failure to add toluene to the crushed seedlings in some instances produced no perceptible difference in the reaction When reasonable care is taken in preparing the material and carrying out the tests there is rarely any considerable variation among a number of tests of one sample.

It has been stated already that the white-clover seed samples used in this investigation were at about the same time subjected to plot trial by the Agrostologist and classified according to the standards employed in the seed-certification scheme in operation at that time. Seed was approved for certification when the better types—namely, types 1 and 2—predominated in the plot. Most of these samples also contained some of type 3. The best samples containing a large proportion of type 1 were classed as mother seed (M.S.); while the others were classed as permanent pasture (P.P.). The samples of inferior quality, composed largely of type 3, were classed reject (R.).

RESULTS.

During the year 1935, 463 samples of seed for which final plot trial reports had been made available were submitted to the test. Table I summarizes the results. It will be seen that there is a high measure of correlation between the grading on plot trial and the classification based upon the "picric acid" test. In other words, a high positive correlation between agronomic quality and cyanogenetic glucoside content is demonstrated. Doak(2) has shown that a similar measure of correlation exists between the hydrocyanic-acid content of herbage and the quality of the strain.

"Mother seed," samples of which there was a total of 66, fell almost equally into Classes 5 and 6, and none fell below Class 5.

Samples placed in the "permanent pasture" grade by the plot trial were predominantly of Class 4, although some are found as high as Class 6 and others as low as Class 2. Twenty-nine samples out of a total of 181 in this group fell below Class 4.

All of the 216 samples rejected on plot trial fell below Class 4.

During the year 1936 comparative tests were carried out on a further group of samples. The experience gained during the previous year's work, together with information obtained from experiments conducted with a view to improving the technique, made it possible to produce more consistent and reliable results than was possible the previous season.

Table II summarizes the results obtained for the 234 samples tested during the past year and demonstrates again the strong positive correlation between the grading by plot trial and the classification based upon the intensity of the reaction in the chemical test. The position is closely parallel to that shown in Table I. The principal differences are as follows: The proportion of "mother seed" samples falling in Class 6 is considerably greater. The proportion of "permanent pasture" samples falling into Class 6 under the chemical test is much smaller, there being only one such in a total of 126. Finally, a small proportion of the samples rejected on plot trial (4 in 90) fell into Class 4 under the chemical test.

In Table III an analysis is made of the samples of each certification grade. The left-hand column gives the composition of the lines in terms of the types to which allusion was made in the introductory section of this article. The groups are arranged according to the predominance of the superior types of plant.

It will be observed that in "mother seed" samples the type 1 predominates, while in the rejected material type 3 predominates. Among samples of the "permanent pasture" grade those showing a higher content of type 1 give a stronger reaction under picric-acid test than do those which comprise largely the lower types.

The relative HCN content of types 2 and 3 is a matter of interest. The present data do not, however, throw much light on this question. A comparison of the distribution according to chemical reaction of samples with a type composition of 2 plus 3 and 3 plus 2 respectively, and again those samples with a type composition of 2 plus 3 plus 1, and 3 plus 2 plus 1 respectively, indicates that type 2 is more highly cyanophoric than is type 3.

USE OF PICRIC-ACID TEST IN THE CERTIFICATION OF WHITE-CLOVER SEED.

Since the commencement of the present year the picric-acid test has been used by the Department of Agriculture as the basis of qualification of white-clover seed for the purposes of certification. Lines falling into Class 6 under the test qualify for the "mother seed" grade. Lines falling into Classes 4 and 5 are included in the "permanent pasture" grade. Other lines giving a lower reaction are rejected from certification.

To define the grades "border-line" control, samples are included with each batch of samples tested. A Lovibond tintometer has been found of some assistance in comparing with the controls tests which lie closely to the border-line. When this instrument is used the colouring-material is leached from the paper strips with a measured quantity of water, and the samples then compared on the basis of the intensity of the red element in the colour of the solution.

An examination of Table III will show what changes may be expected to result from the change from the plot trial to the chemical test as the basis for the certification of white clover. Of the eighteen lines passed as mother seed on plot trial, thirteen would be so classed by the chemical test and the remaining five are placed in the permanent-pasture grade. Of these five, four have a type constitution of 1 plus 3.

Only one in a total of 126 P.P. lines would be raised to the mother-seed grade, and this line is predominantly of the type 1.

Eighteen of the 126 P.P. lines (14 per cent.) are rejected from certification by the chemical test. Of these, thirteen, or over two-thirds, are composed of type 3 plus type 2.

Of ninety lines rejected on plot trial, all are rejected by the chemical test, except four, which fell in Class 4, and are thus graded P.P.

With twenty-eight lines out of a total of 234 (12 per cent.) differences occur in the grading by plot trial and by chemical test. On the other hand, there is agreement in 88 per cent. of the lines.

Table I.—Summary of Results from Samples studied during 1934, showing Correlation between the Classification by the Picric acid Test and the Classification by Plot Trial.

— —	Classification by Picric-acid Test							Total.
	6.	5	4	3.	2.	1	0.	
Grading by plot trial—								
M.S.	34	32	.	..	..	..	..	66
P.P.	8	60	84	20	9	..	..	181
R	..	..	..	90	62	64	..	216
Total ..	42	92	84	110	71	64	..	463

Table II.—Summary of Results from Samples studied during 1935–36, showing Correlation between the Classification by the Picric-acid Test and the Classification by Plot Trial.

——	Classification by Picric-acid Test.							Total.
	6.	5.	4.	3.	2.	1.	0.	
Grading by plot trial—								
M.S.	13	5	..	..	..	..	..	18
P.P.	1	27	80	15	3	..	..	126
R.	..	..	4	48	25	10	3	90
Total ..	14	32	84	63	28	10	3	234

Table III.—Summary of Results from Samples studied during 1935–36, showing Correlation between Type Composition and Classification by the Picric-acid Test.

M.S. = Mother seed; P.P. = permanent pasture; R. = rejected.

Type Composition.	Certification Class.	Classification by Picric-acid Test.						Total.
		M.S.	P.P.		R.			
		6.	5.	4.	3.	2.	1 + 0.	
Classification by plot trial—								
1	M.S.	1	..	..	..	..	..	1
1+2	M.S.	4	1	..	..	..	..	5
1+3	M.S.	8	4	..	..	..	..	12
1+3	P.P.	1	3	3	..	..	..	7
1+2+3	P.P.	..	1	1	..	..	..	2
3+1	P.P.	..	2	8	1	..	..	11
2+1+3	P.P.	..	1	5	..	..	..	6
3+1+2	P.P.	..	2	1	..	..	..	3
2+3+1	P.P	..	9	18	1	..	..	28
3+2+1	P.P.	..	1	10	..	1	..	12
2+3	P.P.	..	8	16	1	1	..	26
3+2	P.P.	..	..	18	12	1	..	31
3+2	R.	..	..	..	5	5	2	12
3	R.	..	..	4	43	20	11	78
Total ..	..	14	32	84	63	28	13	234

ACKNOWLEDGMENTS.

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They are also indebted to Mr. B. W. Doak for advice regarding the technique of the chemical tests.

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The value of suitable top-dressing to induce clover-growth in pastures, particularly paspalum pastures, is to be observed in North Auckland. Right through the winter where such conditions exist the clover has stimulated the paspalum, and this grass has produced feed right through, whereas paspalum pastures lacking clover are yellowish and are making no growth.

NEW-ZEALAND-RAISED SWEET ORANGES.

A. M. W. GREIGG, Orchard Instructor, Auckland.

THE search for a New Zealand sweet orange equal in all respects to imported fruit is the aim of every keen citrus-grower in this country. Whereas one may advocate heat, another the rootstock, soil, or various climatic conditions as the limiting factors, there is one strong advocate for the New Zealand Poorman's orange—he is Mr. Fred. Lippiatt, of Luke Street, Otahuhu Mr. Lippiatt is a firm believer that the best prospects of obtaining the desired fruit are to be secured from Poorman's sports, specially selected budwood from the better class of tree or the cross-pollination of Poorman's trees with sweet oranges.

Confusion is still apparent in the minds of people as to the difference between New Zealand Poorman's orange and New Zealand grapefruit. There is none other than in quality. An orange-tree imported from India and grown by the late Sir George Grey at Kawau Island bore such a crop of fine oranges, although with a distinct flavour, that the remark was passed, "That's a poor man's orange." Budwood from this tree established the New Zealand Poorman's orange throughout the country. During recent years grapefruit has become popular, especially in the United States, and the suitability of the New Zealand Poorman's orange for grapefruit purposes induced a local firm to popularize the fruit under the name of New Zealand grapefruit. Only good, well-matured fruit should ever be marketed under this name, otherwise the old prejudice against the Poorman's orange will again have to be lived down.

Mr. Lippiatt has held the belief for forty years that a sweet orange adapted to New Zealand conditions could be evolved from the New Zealand Poorman's orange, but it is only during the last ten years that he has started to put that belief into active practice. The New Zealand Poorman's has proved itself a powerful grower and heavy cropper under a wide range of conditions, but hybridization towards an improvement in flavour is necessary in the effort to obtain a New Zealand sweet orange. Mr. Lippiatt appears already to have evolved a sweeter fruit, which, even though it cannot yet be classified as a sweet orange, should improve the demand for New Zealand grapefruit, as according to an authority, Mr. Harvey Turner, fruit-merchant, of Auckland, a sweeter fruit was desirable for the New Zealand grapefruit trade, and Mr. Lippiatt's seedling appears promising for that purpose.

HISTORY OF SEEDLING.

The history of Mr. Lippiatt's seedling, although not a direct outcome of his theory of a sweeter Poorman's orange, yet throws an interesting light upon the history of the New Zealand Poorman's.

About ten years ago a citrus-grower named Mr. T. W. Hewett, of Aitutaki, Cook Islands, used to market his fruit through the firm of Messrs. Turners and Growers, Auckland. On visiting the markets one day Mr. Harvey Turner directed the attention of Mr. Fred Lippiatt, of Otahuhu, to a very fine grapefruit from a case of mixed fruit sent Mr. Turner from Aitutaki. At lunch that day Messrs. H. Turner,

S. Thompson, F. Lippiatt, and J. W. McMicken sampled this grapefruit, and all were impressed by its fine qualities—large, 8 in. in diameter, thin-skinned, similar in appearance to an Island orange, and very juicy. Mr. Lippiatt was so impressed that he insisted upon taking all the seeds home and planting them there. From the fifteen seeds he obtained sixteen seedlings. Obtaining more seedlings than seeds planted is fairly common in citrus, and is due to the phenomenon known as polyembryony, which arises through the development of embryos from other cells within the ovule. This embryo is haploid and the seedling which grows from it is generally smaller than the

TREE RAISED FROM ONE OF MR. LIPPIATT'S ORIGINAL IMPROVEMENT POORMAN'S SEEDLING TREES, SHOWING THE WAY IN WHICH THE SEEDLING HAS GROWN EVEN WHEN PLACED ON A STRONG STOCK. THE BUD IS THE RIGHT-HAND GROWTH, AND THE STOCK THE LEFT.

seedling from the fertilized ovum—a diploid cell. Mr. Lippiatt is taking special note of the cases in which two or more seedlings grow from one pip.

The sixteen seedlings showed a wide variation in general characters—foliage, thorns, and nature of growth. Some appeared better, some worse, than existing types of New Zealand citrus. All showed orange, grapefruit, or mandarin foliage in a more or less marked degree. The reason for the wide variation is explained by cross-pollination. Citrus is generally propagated vegetatively or asexually by means of buds in order to reproduce a tree true to type. In the case of planting seeds which are really the fertilized eggs or ova known as the zygote, all the heredity characteristics or genes of both male and female gametes will appear. The New Zealand grapefruit is itself a hybrid between an orange and a pomelo. What, then, could be expected from this Island grapefruit which had been cross-pollinated by the sweet oranges of the Islands. It was on this theory that Mr. Lippiatt was working, and from it he hoped to obtain a wide range of seedlings. This is what actually resulted. To say at this juncture that he hoped to obtain an improved Poorman's or an orange suitable for New Zealand conditions would be quite incorrect. He had no idea what would result. They might all have been useless It was the system by which many great discoveries have been made—the trial and error method.

INFLUENCE OF HUMIDITY.

The grapefruit succeeds better than the orange under conditions of greater relative humidity. This is shown by the superiority of Florida grapefruit over Californian, whilst the reverse is true regarding oranges, which do better under irrigation conditions. Mr. Lippiatt's seedlings showed their grapefruit ancestry in that the fruit is borne as a cluster or spray, not as individual fruits as with oranges. They also fruited earlier than would Island orange seedlings under similar conditions.

From the sixteen seedlings fruit has now been obtained from nine. Fruit from six of these was valueless and need not be considered further, but fruit from trees numbered 1, 2, and 3 is of interest. To deal with No. 3 first: This tree is at present growing on the property of Mr. R. W. Nicholls, of Mangere, but the remarkable feature about the fruit was that it appeared identical with that of New Zealand Poorman. When Mr. Lippiatt took one fruit of No. 3 and two ordinary Poorman's oranges into Messrs. Turners and Growers, out of half a dozen people not one picked the seedling. When cut and tasted one could not distinguish it from the Poorman's except that the centre is a hollow core, not solid as in Poorman's, and the flesh is a deeper golden colour. How, then, came this fruit from a seedling tree raised from an Island grapefruit to be similar in every way to a New Zealand Poorman's? The history of the New Zealand Poorman's as outlined above shows it to have been imported from India, and inquiries regarding the imported Island grapefruit resulted in the discovery that Mr. Hewett had received his trees as a gift from an Englishman after his return to India following a visit to the Islands. The fruit from these trees is not now sold locally, as

Mr. Hewett has died and his orchard has changed ownership. This fruit resembling the New Zealand Poorman's thus confirms the theory as previously advocated by leading citriculturists that the New Zealand Poorman's is a hybrid or cross between the sweet orange and the Indian pomelo.

Seedlings numbered 1 and 2, however, are now the ones from which Mr. Lippiatt hopes to obtain a finer strain of grapefruit. The fruit obtained was a sweeter grapefruit or a stage nearer the result of a suitable New Zealand sweet orange—that is, one adapted to local conditions, equal to the imported fruit in quality and flavour and suitable to the grower in bearing good regular crops of high quality. Besides being sweeter than New Zealand Poorman's, it is also a good commercial size and thin-skinned. Unfortunately, Nos. 1 and 2 growing on their own roots have died of collar-rot, but before dying No. 1 had set a crop of approximately 260 fruit, indicating it should be a good cropper. The soil of the area is rather heavy and wet, and pomelo or its derivatives is not a rootstock resistant to unfavourable conditions. Realizing that his two best seedlings were dying, Mr. Lippiatt made a fine effort and has saved the valuable budwood of No. 1. The buds were inserted into younger seedlings. This is not a usual procedure, and in normal circumstances would be considered as senseless to put buds of a tree on to a similar rootstock, but these seedlings were all that Mr. Lippiatt had available at the time.

The seedlings were raised from the seed of five cases of similar fruit from a consignment from Aitutaki four years later. These seedlings were sown in a small nursery area at the rear of the house, and, owing to unfortunate circumstances, were neglected for a year or two. Some of the seedlings were given to a nurseryman, who used them as stocks and thus are lost to the industry, others have been given away, but a considerable number remain on the property. The No. 1 budwood has been put on these and the stock or secondary seedling root has been allowed to remain in order to see if any other good-quality fruit result. One remarkable feature, however, of the No. 1 bud is that in all cases it has developed, even after being dormant for a year. It becomes a vigorous shoot and forms naturally a fine tree without any necessary forming by the nurseryman. The No. 1 trees show remarkable vigour, fine foliage, and the black-streaked bark so characteristic of the New Zealand Poorman's. No. 1 was growing on Mr. Lippiatt's property. No. 2 grew at Mr. Graham's across the road. It died as a result of the storm of February, 1936, but fruit borne was practically identical with that of No. 1.

Already the news has spread of this promising seedling, and although one is quite unable to secure any sample fruits until the No. 1 buds again reach fruiting-age, yet several nurserymen are working up the variety on different stocks, so that in a few years the capabilities of this seedling will be seen under varying conditions. Growers are already making inquiries, but another two years will probably elapse before the seedling is released for sale.

In the meantime Mr. Lippiatt has indicated the manner in which progress and research can be made towards finding the ideal New Zealand sweet orange, and to him the citrus industry is indebted for his interest and zeal over the past ten years.

HALF-YEARLY FERTILIZER RETURNS.

The following returns have been compiled by the Inspector of Fertilizers, Fields Division, Department of Agriculture, from figures supplied by the courtesy of the Comptroller of Customs :—

(Figures in Tons.)

Fertilizer	Origin.	Jan.	Feb.	Mar.	First Quarter.	April.	May	June.	Second Quarter.	Half-yearly Return.
				Phosphates.						
Rock ..	Gilbert and Ellice Islands	15,380	4,129	14,310	33,819	2,581	11,503	1,003	15,087	48,906
	Nauru ..	9,017	6,186	.	15,203	15,854	11,383	38,446	65,683	80,886
Total ..	..	.	.	..	..	..	..		..	129,792
Slag .	United Kingdom	155	1,050	15,703	16,908	12,638	1,729	401	14,768	31,676
	Belgium	225	10,435	12,303	22,963	8,260	9,115	250	17,625	40,588
Total .	.	..	..	..	..	.	..	..	..	72,264
Guano	United Kingdom	..	..	..	..	.	..	5	5	5
	Seychelles ..		10,379	..	10,379	.	.	2,980	2,980	13,359
Total	.	.	.	.	.	..	..	..	..	13,364
Other phosphatic manures	Egypt .	..	..	..	.	..	.	2,700	2,700	2,700
	Belgium	..	400	3,285	3,685	1,135	3,672	625	5,432	9,117
Total ..	..	.		.	.	..	.	..	..	11,817
Total, phosphates ..		..	.	..	..	..	..	.	..	227,237
				Potash.						
Kainit ..	Belgium	..	.	25	25	..	..	..	..	25
	U.S.A. ..		25		25	50	..	20	70	95
	Germany	..	105	..	105	20	205	..	225	330
	France .	20	20	..	40	..	.	25	25	65
Total	.	.		..	..	..	.	..	..	515
Sulphate .	France	25	.	5	30	85	105	25	215	245
	Germany	10	75	5	90	126	49	161	336	420
Total		.				..	..	..	..	671
Muriate ..	France	.			.	55	.	35	90	90
	Germany ..	4	..		4	22	1		23	27
Total .	..	..	..	..	..	.	..	..	..	117
Other ..	France ..	100	780	1,400	2,280	435	525	450	1,410	3,690
	Belgium ..	..	5	30	35	..	..	..	..	35
	Germany ..	35	1,437	678	2,150	460	922	735	2,117	4,267
Total ..	..	..	.	..	..	..	..	..	..	7,992
Total, potash ..		..	..	..	..	.	.	..	..	9,295
				Nitrogen.						
Sulphate of ammonia	United Kingdom	135	440	..	575	800	278	450	1,528	2,103
Nitrate of soda	United Kingdom	175	..	..	175	..	..	..	..	175
	Chile ..	..	469	..	469	115	314	75	504	973
	Netherlands ..	1	..	..	1	..	..	..	..	1
	U.S.A. ..	..	..	400	400	..	50	75	125	525
Total, nitrogen ..		..	..	..	.	..	..	..	..	3,777
				Miscellaneous.						
Miscellaneous	Australia ..	..	..	10	10	..	..	..	..	10
	United Kingdom	1	20	13	34	54	42	4	100	134
	India ..	..	..	..	.	.	..	2	2	2
Total, Miscellaneous ..		..	..	..	..	..	.	.	.	146
Totals ..	..	25,283	35,955	48,167	109,405	42,690	39,893	48,467	131,050	240,455

MOLE DRAINAGE IN THE MANAWATU.

By C. J. Hamblyn, Fields Superintendent, Palmerston North, and
A. J. Galpin, Fields Instructor, Palmerston North

For many years the mole-drain plough has been used in the Rangitikei, Manawatu, and Woodville districts of the Wellington Province in an endeavour to improve cheaply and effectively the drainage on extensive areas of the heavy loam soils which overlie stiff impervious clay subsoils. The bulk of the country on which mole drainage has been practised consists of rolling and flat-topped low hill country bordering the river flats and river terrace land. Much of this country is dissected by narrow valleys and deep depressions, while in other areas the land gently slopes away from the general level to wide open valleys. The majority of the land is ploughable. The soils are fertile, but there is a definite tendency to rapid reversion of pastures to dominant brown-top, due to the excessively wet condition of the surface soil in winter. Rushes are a serious problem, foot-rot is bad in sheep, pastures are frequently badly poached by cattle in wet winters, and the spring growth is backward.

Mole drainage has often given disappointing results from the point of view of lasting improvement, and many well-established farmers have resorted eventually to the much slower, infinitely more expensive, but more lasting method of tile drainage.

Twelve years of practical experience with the mole-drain plough on his property at Colyton in the Manawatu has resulted in the development by Mr. Bruce McLeod of a method of mole drainage which is thorough, very efficient, relatively cheap as compared with tile drainage, and, what is still more important, promises to be lasting.

The guiding principles in Mr. McLeod's method, though simple, are yet of extreme importance in successful and lasting mole drainage. First, the provision of permanent outlets; second, the provision of a definite and uninterrupted fall from the highest point of each mole drain to the outlet; and third, provision of a sufficient force of water especially near the outlets to clear the system of silt at the commencement of the rainy season. Though the actual mole drain will last for many years when drawn in a suitable clay subsoil, it is the gradual accumulation of fine silt which eventually blocks the drains and renders them useless. During dry summers the soil dries out down to the mole drains and the sides tend to flake. At the beginning of the rainy season there is a deposit of silt in the mole drains. This silt cannot be cleared from the system if the outlets are blocked, nor can it be cleared if there is little or no fall. The special tendency to silt up in depressions is the reason for maintaining a steady but definite fall throughout the course of each drain.

Mole drainage of the 300 acres of Mr. McLeod's homestead portion of his farm has recently been completed with the new system. The first paddock was dealt with five years ago. It is believed that the methods adopted will prove of interest and value to farmers in various parts of New Zealand where similar conditions occur, and for this reason are here described and illustrated.

The chief feature of Mr. McLeod's system is the elimination of the usual large number of individual mole-drain outlets which are so liable to blockage. This is done by using one in every four to eight mole drains as an outlet for the group, and, further, the gathering of as many of these outlet drains to discharge at a suitable selected place where a permanent tiled outlet can be put in. In this way the drainage from forty to fifty or more individual mole drains can be collected to discharge at one point, and the number of outlets required for the complete mole drainage of a large area reduced to a minimum. The provision of material such as tiles for permanent outlets is then not costly.

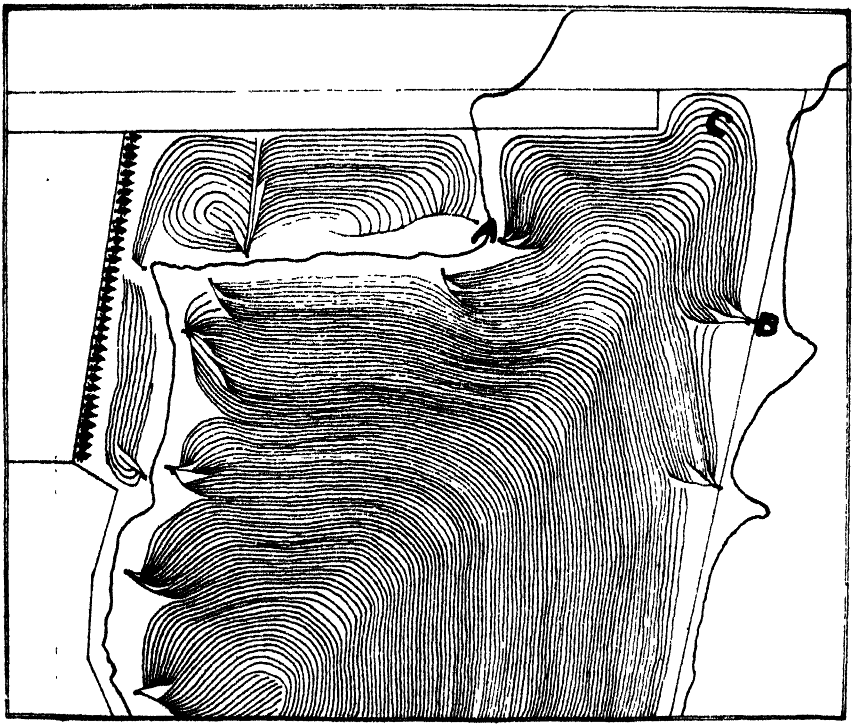


FIG. 1. PORTION OF A COMPLETED SCHEME OF MOLE DRAINAGE ON A 32-ACRE PADDOCK, SHOWING OUTLETS A AND B AND RIDGE C REFERRED TO IN TEXT.

LAYOUT OF DRAINAGE SCHEME.

A study is made of the paddock or area to be mole-drained, particularly when heavy rain has fallen, and in addition to the selection of suitable locations for outlets, the run and line of the mole drains is roughly schemed out. For this purpose a dumpy level is invaluable. The eye is often deceived regarding the direction of fall.

The number and location of outlets is worked out in relation to the general lie of the country. The possibility of gathering together near the outlets as many mole drains as possible so as to reduce to a minimum the number of main outlets required is the chief guide in selecting these outlets.

As a general principle mole drains are most effective when they run across the steepest slope, but a steady and definite fall must be maintained from the highest point to the outlet with a more decided fall if possible just before the point of discharge. The drainage of such country as at Colyton, gently rolling for the most part, with steep slopes to watercourses round the edge of the paddocks, lends itself admirably to the methods developed, but it is surprising how the same system of collecting mole drains for discharge at selected outlets can be adapted to varying conditions on different types of country. It is occasionally necessary to alter the line of fences to give access to suitable outlet locations.

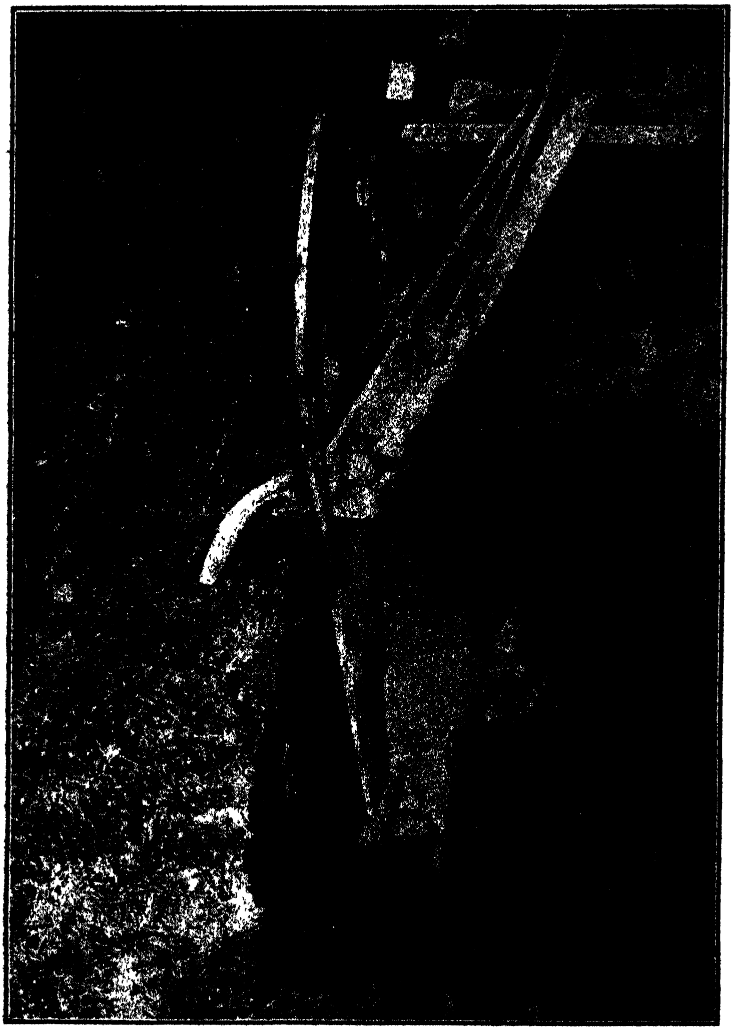


FIG. 2. THE MOLE PLOUGH SET UP IN THE OUTLET READY TO BE DRAWN ACROSS THE BLIND ENDS OF INTERMEDIATE MOLE DRAINS ALREADY DRAWN.

Fig. 1 illustrates portion of a completed scheme of mole drainage on a 32-acre paddock, and shows the location of fences and of the outlets which discharge down the banks bordering the watercourses. The outlets consist of short trenches dug back from the point of discharge whatever distance is required to give easy access for the mole plough.

DRAWING THE MOLES.

Having fixed the site of two outlets such as A and B in Fig. 1, the mole plough is set up near outlet A and following round the contours and over the ridge at C the plough is tripped and leaves the ground near outlet B. The tractor turns, the plough is set up again near outlet B, and a parallel mole drain is drawn 6 ft. to 9 ft. or up to 11 ft. from the first drain. The plough is next tripped at outlet A, and the process repeated until four to six mole drains are drawn. The plough is next set up in the outlet drain A, Fig. 2, and without altering the depth is drawn so as to cut across the blind ends of the drains already drawn. This drain is continued on as an ordinary mole drain to outlet B. The plough is then set up in outlet B, and again the plough is drawn so as to cut across the previously made mole drains. The process is illustrated in Fig. 3. The method of cutting across the ends of groups or fans of completed drains with gathering drains opening into the outlets is continued across the field. New outlets are made use of as the work proceeds. Where it is not possible to work to two outlets the mole is drawn to the highest point required away from the outlet, the tractor turned, and a parallel drain drawn back to the outlet.

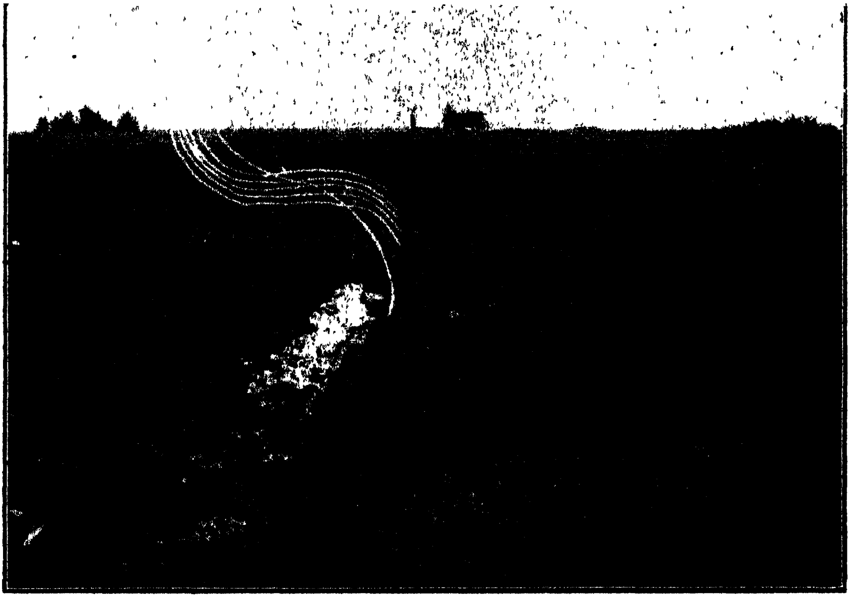


FIG. 3. AN OUTLET DRAIN SHOWN CUTTING ACROSS THE ENDS OF FOUR INTERMEDIATE DRAINS AND CONTINUED ON AS AN ORDINARY MOLE DRAIN.

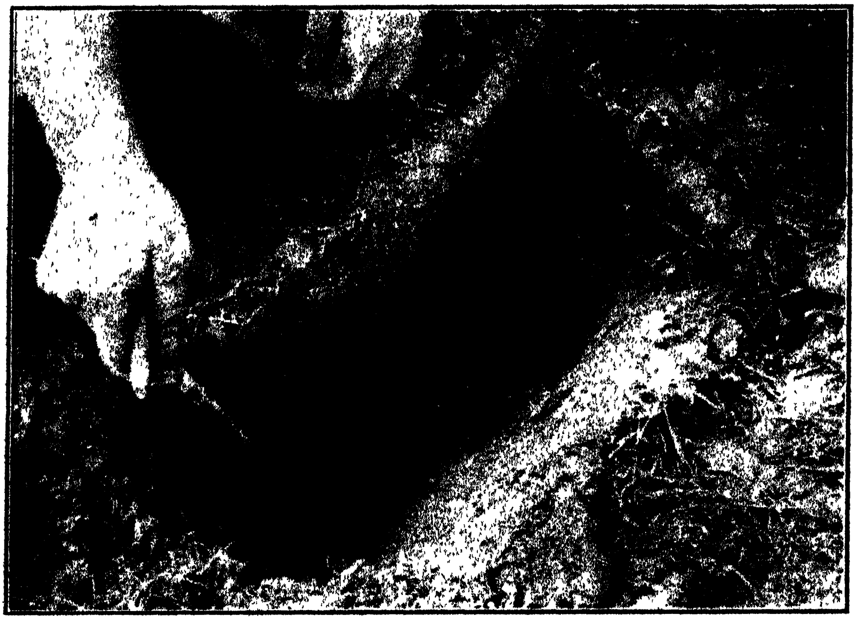


FIG. 4. ILLUSTRATES THE HOLE DUG IN THE BLIND END OF THE INTERMEDIATE DRAINS AND THE CLEARANCE OF THE CLAY PLUGS WITH THE CORKSCREW IMPLEMENT

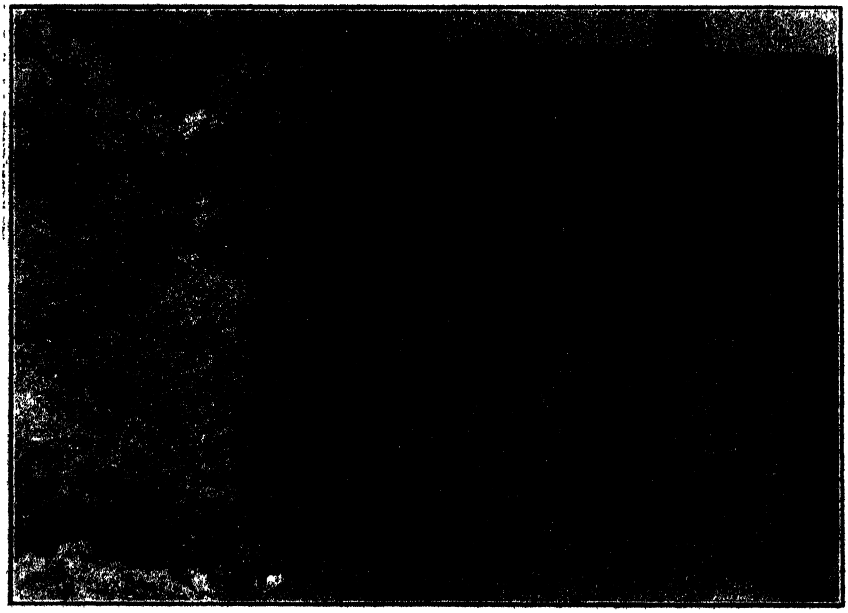


FIG. 5. A SERIES OF OUTLET MOLE DRAINS DISCHARGING INTO THE OUTLET TRENCH. Each of these outlet mole drains is connected with 4 in. to 6 in. or more intermediates.

The same method of cutting across the ends of groups of these drains with a mole drain discharging direct into the outlet is adopted. It will be noted that the mole plough is in the ground the whole of the time with the exception of the short turns, and that no time is wasted running back to the outlets empty.

LINKING UP OUTLET DRAINS WITH INTERMEDIATE MOLE DRAINS.

Each of the intermediate drains terminates in a blind end, and while the tractor work is going on the work of connecting these intermediates up with the outlet mole drains leading to the outlet ditches is proceeded with. The crossing of these intermediates with a mole drain intended as an outlet results in the complete blocking of the first drawn drains, whether the outlet drain is drawn at the same level as in this case, or within 2 in. or 3 in. either above or below. For the purpose of providing for the free passage of water, and, what is more important, for the clearance of silt in later years from the intermediates to the outlet drain, a clean, full-sized connection must be made between them. This is easily and rapidly accomplished with the aid of a simple tool, made in the form of a corkscrew, with a universal joint in the handle.

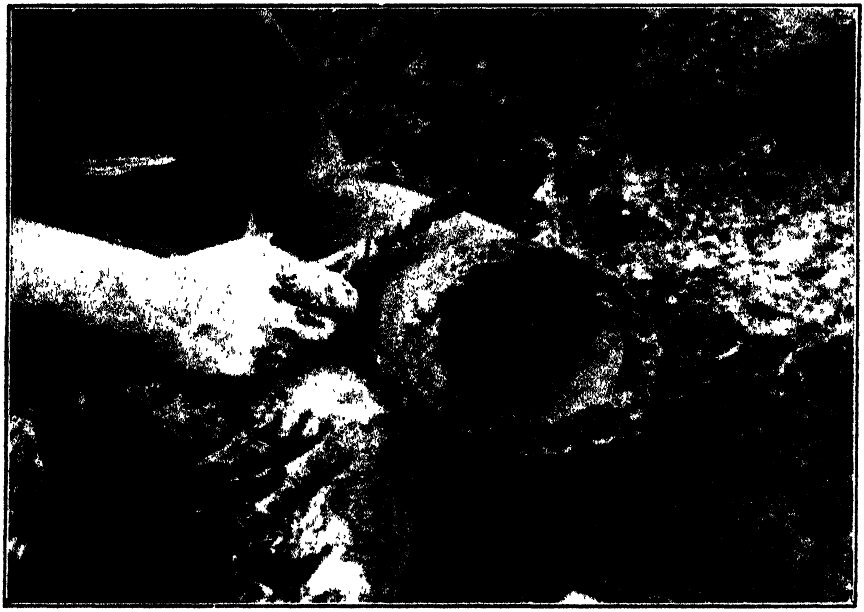


FIG. 6. IMPLEMENT USED FOR MAKING HOLES IN TILES AND CUTTING TILES TO LENGTH REQUIRED.

The points where the outlet drain cuts each intermediate are marked; a hole is dug in the blind end of the intermediate down to the mole drain so as to cut it at a short distance from its junction with the outlet drain. The special corkscrew augur with a universal joint is then used, as illustrated in Fig. 4, to clear the clay plugs blocking this drain. With the removal of these plugs, if there is sufficient water in the mole drain, it will run into the hole which was dug, but can be diverted to the outlet drain by plugging up with good clay the open end of the mole drain which has just been cleared. The hole is then filled in and the connection is completed.

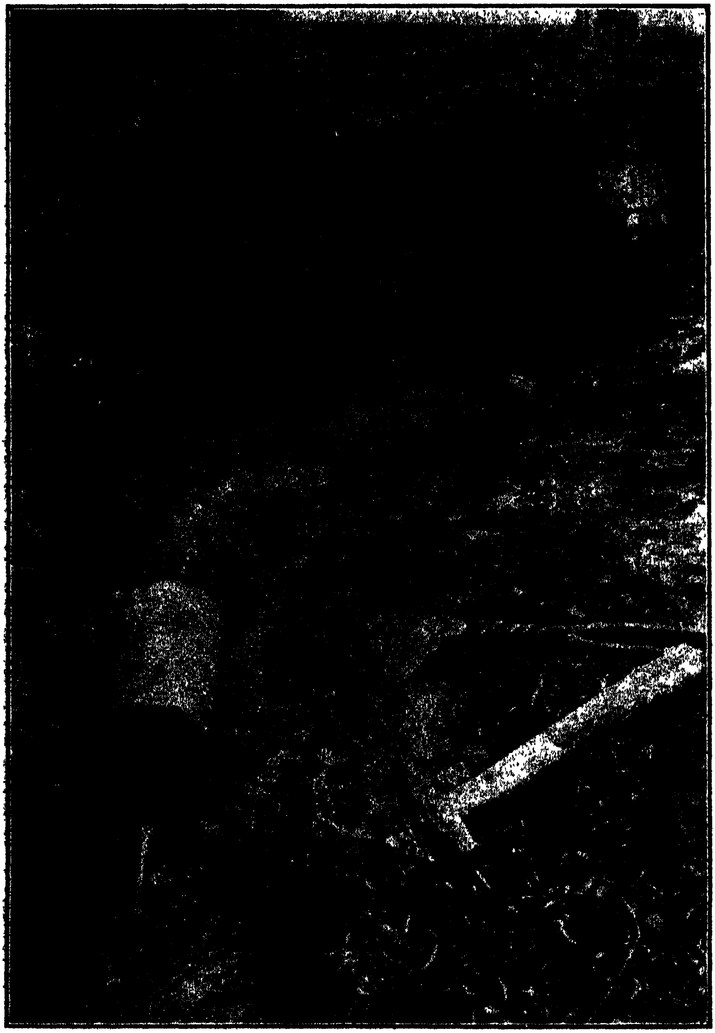


FIG. 7. FOUR-INCH TILES FITTED IN THE OUTLET AND CONNECTIONS WITH THE OUTLET DRAINS.

Note packing of clay round tiles and over the outlets.

THE PERMANENT OUTLETS.

The final process is the laying of tiles, preferably 4 in. unglazed drain tiles, in each of the outlet ditches to give a permanent outlet not likely to be trampled in and blocked by cattle or sheep. The bottom of the outlet trench into which the outlet mole drains have been drawn, as shown in Fig. 5, is built up so that the tiles when laid will be close up to these openings. Holes are made with the implement shown in Fig. 6 in the sides of the tiles opposite the mole drain outlets, and pieces of tile or special short lengths of 2½ in. tile are used to make a direct connection between the moles and the tile drain. Sticky clay is then used to pack over the connections and along the length of 4 in. tiles to ensure a permanent job (Fig. 7). The outlet is then filled in. The implement used for cutting tiles to suitable lengths and for cutting holes in the sides of the tiles is made from an ordinary worn mower-knife section fitted to a short handle. The hammer is used to punch out the hole when the outline is sufficiently chipped with the other implement.

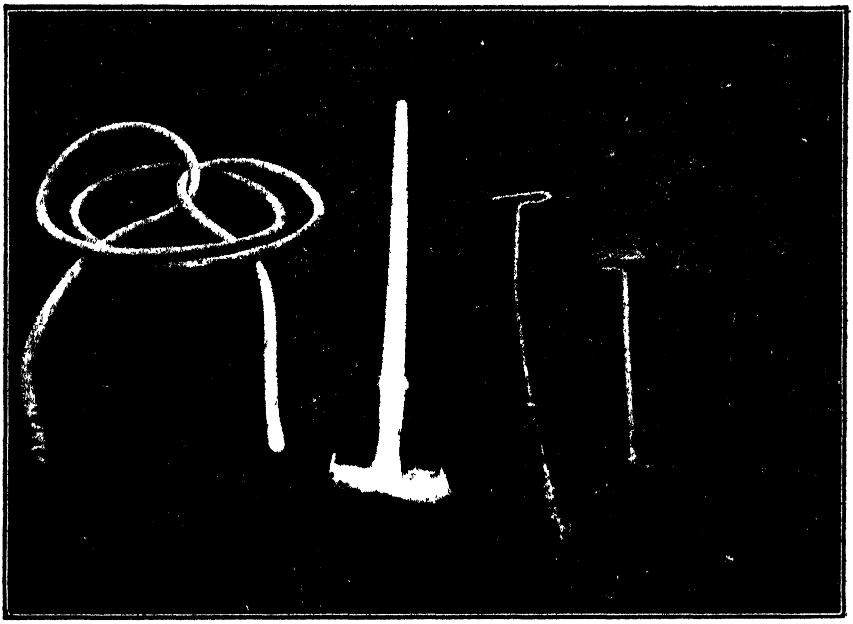


FIG. 8. SOME OF THE OTHER TOOLS USED AND DESCRIBED IN THE TEXT

The length of ¾ in. hose fitted with a corkscrew at one end and a plug of hardwood at the other is useful for clearing obstructions in the outlet drains when, as sometimes occurs, the plugs are not properly cleared from the intermediates. It is also useful later in clearing obstructions such as silt accumulations near the outlets and in maintaining the drains in good order (Fig. 8).

EFFICIENCY OF THIS METHOD OF MOLE DRAINAGE.

The effectiveness of mole drainage is illustrated in Figs. 9 and 10. Fig. 9 shows the surface of a paddock as yet undrained, the pasture weak and open, the soil wet and sloppy—ideal conditions for sheep parasites and bad foot-rot, and always liable to rush invasion. Fig. 10 illustrates the conditions on an adjoining field mole-drained for four years and sown to the same good rye-grass and white clover. The rye-grass and clover are flourishing, with little chance of reversion to brown-top or rushes. The surface is dry and firm and able to carry heavy cattle during the winter.

FIG. 9. TYPICAL WINTER CONDITIONS OF UNDRAINED LAND AT COLYTON.

PERMANENCE AND RENEWAL.

Most of the usual methods of mole drainage on such country had been tried out during some twelve years by Mr. McLeod, including the connection of deeper outlet drains with intermediates by means of a spear or the use of totara slabs placed over the junction when this had been cleared. His experience has been that generally the efficiency of the drainage has improved up to about three years, then there has been a rapid falling-off in the effectiveness. Wet patches appear and spread throughout the field, until the system has to be renewed in about five years. Although the first area drained by the new method has been done for five years only, the fact that there has been a steady improvement in the effectiveness of the drains during this period and that the discharge of water at the outlets after rains is still as good as ever indicates that a much more permanent and satisfactory job has been done. Renewal of the drainage system if and when required is not difficult in that to commence operations all that is required is to dig out the short length of tiles from each outlet.

COSTS.

Detailed costs for the complete mole drainage of the 32-acre area from which the illustrations in this article were obtained are as follows:—

	£	s.	d.
Fuel, 42 gallons at 1s. 1d.	2	5	6
Oil, 29 hours at 3d. per hour	0	7	3
Wages, 3 men, 29 hours, at 2s. per hour ..	8	14	0
Depreciation tractor and plant at 1s. 6d. per hour	2	3	6
Tiles for outlets	0	18	0
Wages, 2 men, 8 hours, at 2s. per hour (tiling outlets)	1	12	0
Total	£16	0	3

Cost per acre, 10s.

SCOPE OF MOLE DRAINAGE.

The essential conditions for satisfactory mole drainage are—

(1) A suitable stiff clay subsoil free from obstructions such as ironstone pans, roots, or large stones, which would interfere with the drawing of the mole-drain plough through the soil.

(2) The stiff impervious subsoil must be within 20 in. to 22 in. of the surface, as this is the maximum depth that the usual plough will go.

(3) There must be an appreciable fall in the direction of the mole if the drains are to last.

On flat land or land with little fall mole drains do not last, but are often well worth putting in because of their effectiveness while they last.

There are many thousands of acres of country in the Manawatu, Rangitikei, and southern Hawke's Bay Districts with conditions almost ideal for effective and lasting mole drainage. Fig. 10 is a typical illustration of such country. The free drainage of several inches of dark loam soil is held up by a stiff impervious clay subsoil, the fall is generally good, and suitable places for outlets are easily found. The lower ploughable slopes of much of the steeper hill country in many districts lie wet and cold in the winter because of the stiff subsoils, and the mole plough can be used with good results on such land. In many other districts, particularly in North Auckland and Southland, the stiff clay soils can often be drained and improved by mole drainage and the method described above adopted with advantage.

The mole plough is not effective on relatively loose and open soils where the drainage may be bad on account of a pan formation. Mole drainage, though effective, cannot be made lasting on relatively flat land, such as river flats and swamp land, even where the subsoil may be ideal for the purpose. The fall is not enough to keep the drains cleared of silt, and they rapidly tend to silt up, although the outlets may be kept clear.

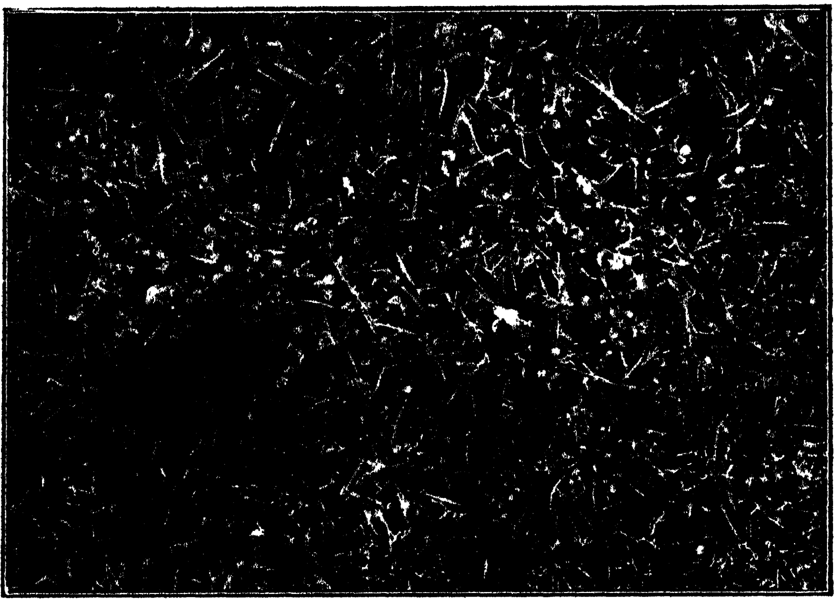


FIG. 10. EFFECT OF MOLE DRAINAGE—CONDITIONS GOOD FOR THRIVING PERENNIAL RYE-GRASS AND WHITE CLOVER.

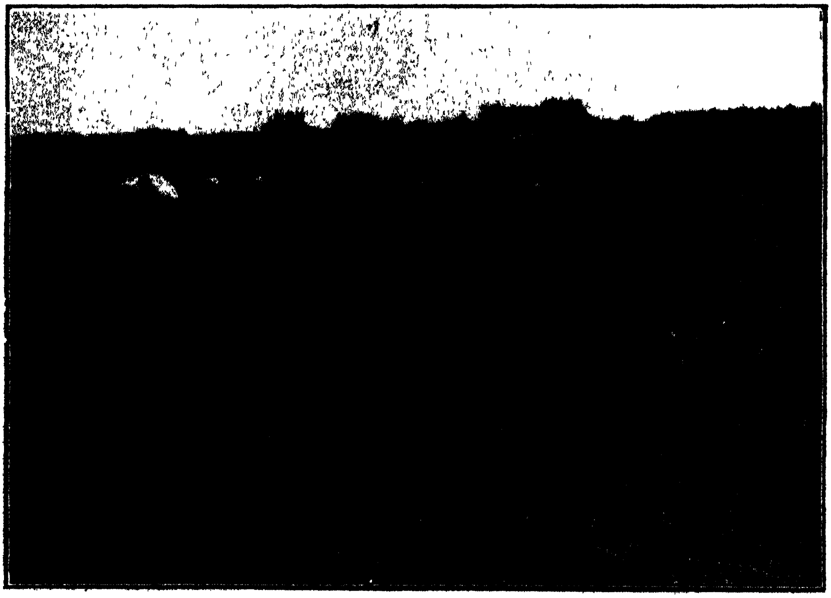


FIG. 11. PORTION OF MR. MCLEOD'S FARM AFTER EFFICIENT MOLE DRAINAGE SHOWING ABSENCE OF RUSHES AND DENSE SWARD OF RYE AND CLOVER.

If mole drains will last, however, for three to four years, as they often do in land with a slight fall, and can be put in for a few shillings per acre, the effective removal of surface water is well worth while. The renewal of the drains is easily done when a tractor and mole plough working to suitable open drains can do up to 15 to 20 acres per day.

Opinions vary as to the best depth to draw the moles and the best time to do the work, but the following general recommendations are considered sound under average conditions.

DEPTH OF DRAINS.

A minimum depth of 12 in. with the plug working at least 2 in. in the clay subsoil is advisable. With mole drains nearer the surface the sides of the drain are likely to crumble rapidly in dry weather. There is also the danger of damage to the drains at soft spots by heavy cattle or by the plough. Mole drains drawn deep in the clay, particularly in stiff impervious clays, are generally ineffective, the water taking too long to pass into the drains Deep drains, however, last well. In practice, a depth of 14 in. to 18 in., with the mole drains about 3 in. in the subsoil, is found to give good results in rapidity of drainage and in lasting drainage.

TIME TO DRAIN.

The best time to do the work is when the subsoil is wet and the surface dry. The dry surface means less cutting about and more effective pulling-power of the tractor. The wet subsoil ensures less draught and good clean mole drains. Suitable conditions seldom occur both in respect of the dry surface soil and wet subsoil until the land is drying out in the spring. September and October are often good months in which to do the work. Mole drains drawn under very wet surface conditions are liable to blockage by soil going down the knife cuts. The results, however, are quick and spectacular, and there is a tendency therefore to do the work under these conditions which are not at all favourable for lasting work.

There are a number of other points regarding mole drainage—the size of plug, speed of the plough, pulling across the steepest slope, not crossing depressions, correct spacing, and many others which should be considered. A 2½ in. to 3 in. plug is generally used, and this size of plug is suitable to most conditions. The stiffer and stickier the soil the smaller the plug, and *vice versa*.

The best speed for the plough is about two miles and a half to three miles per hour. Fast work is not desirable, as the drain-sides tend to be drawn in, and in somewhat dry soils will flake.

Although it is held that the mole drain lasts better if drawn away from the outlet and up the slope, this is not essential to good work. Permanent outlets and the provision of sufficient pressure in the stream of water down the moles is considered of far greater importance, and also the saving of time when the plough is kept in the ground continually.

Depressions should not be crossed, as silt is liable to collect in the depressions in the drains and cause blockages. The modern type of light mole plough can be used to cross narrow finishes and fearings, as the general depth of the mole drain is not affected in crossing these (Fig. 11). An effective spacing in most soils is about 9 ft., but on very wet, stiff soils the moles should be as close as 6 ft. Mole drains should be close together when running down the grade and wider apart across the fall or steeper slopes.

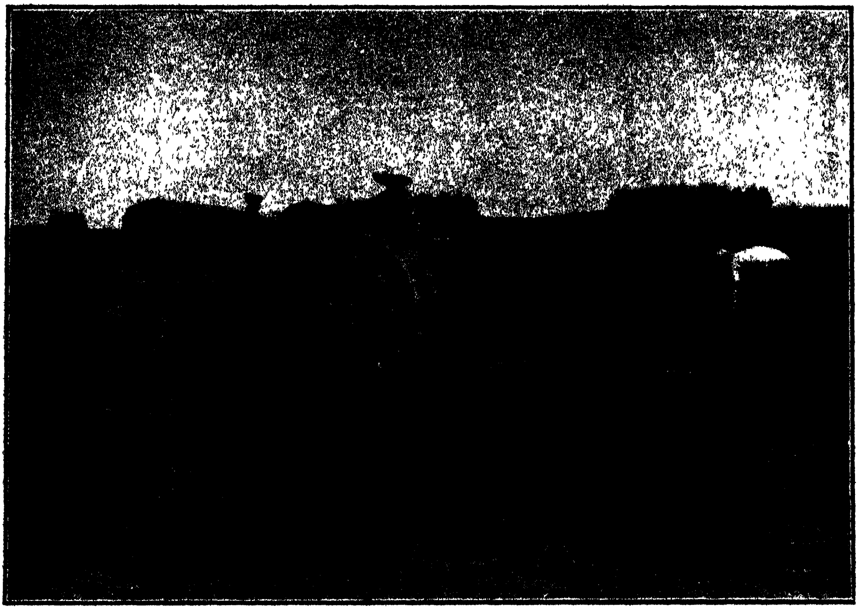


FIG. 12. THE LIGHT, EASILY ADJUSTED TYPE OF MOLE PLOUGH FAVOURED IN THE MANAWATU DISTRICT.

CONCLUSION.

The method of mole drainage described in this article is confidently recommended to those practising mole drainage under similar conditions, and farmers are further recommended to consider the possibilities of the mole plough where good drainage is required.

The writers wish to record their thanks to Mr. McLeod for making available the practical details of his methods, and also to the official photographer, Mr. Harvey Drake, who is responsible for the illustrations.

The importance of surface-sowing subterranean clover at the most suitable time has been well shown in the Manawatu district in the past season. Areas sown in early February appear much further ahead, both in number of plants germinating and also in their vigorous growth, than areas sown later in the autumn. This year, owing to the high summer rainfall, subterranean clover could be sown much earlier than usual with good results, and those that took the opportunity appear to have been well repaid.

SEASONAL NOTES.

THE FARM.

A Cause of Poor Results from Top-dressing in Lamb-production.

RECENT official statistics show that last year's record number of breeding-ewes in the Dominion has been exceeded this year. This new record number of breeding-ewes probably is, and certainly might fittingly be, connected with the evidence from sales of fertilizers that increased top-dressing of grassland has been carried out in the sheep-farming of at least several districts; there is much farm experience indicating that judicious top-dressing of suitable pastures can be made a direct and profitable means of producing greater numbers of better lambs. Such experience continues to become available in increasing volume not only from districts of more than 30 in. of annual rainfall, but also from ones of considerably less rainfall

While the general position is that top-dressing has been found of value in producing a bigger and more profitable crop of lambs, it is desirable to bear in mind, especially at this season of the year, that farmers are to be found in both the North Island and the South Island who, on the basis of personal experience, state unhesitatingly that top-dressing has been associated with poor results in the production of lambs. Close scrutiny of their experience often has certainly confirmed their statements, but at the same time has provided an explanation of the poor results It is of great practical importance that this explanation has in no respect affected the general validity of the fact that over wide areas top-dressing may be employed to increase the output and the net returns in lamb-production.

In short, top-dressing has been linked with exceptionally good results and quite poor results in lamb-production, and this in the one district under similar conditions of soil climate and original pasture-covering and with the same type of top-dressing material used when the results were both good and bad. This somewhat paradoxical position arises primarily from the fact that using fertilizer on grassland and using the results from fertilizer on grassland are two totally different matters; or, expressed in other words, it is of great practical importance to distinguish between applying fertilizer and using fertilizer on grassland having in mind that, according to the dictionary, "use" means "application to a purpose." In farming, and especially in sheep-farming at times, the application of fertilizers to pastures has been judicious, while later on the use of the results of the fertilizers has not been judicious.

The crux of the position is given pithily in the following statement of Dr. Fraser of Rowett Institute:—

"Ewes and lambs will never thrive on stemmy pastures . . . I have repeatedly noticed how lambs go off when grass shoots and clover flowers."

This statement introduces no new idea: it merely emphasizes a fact that is demonstrated throughout a countryside whenever that countryside enjoys weather that favours unusually rapid growth of pastures in spring and early summer and the sheep-farmers do not take adequate measures to cope with the surplus feed that results. Judicious top-dressing begets additional feed just as favourable weather conditions may beget additional feed: either top-dressing or favourable spring and early summer weather may lead to poor results with lambs unless the surplus feed is handled in such a way that stemmy pastures for the ewes and lambs are avoided.

Phosphatic top-dressing when it is effective, as it so commonly is, intensifies the superabundance of feed directly available from grassland in the late spring and early summer. Hence if top-dressing is not followed by measures for dealing with an increased supply of feed at this period, then usually and almost necessarily a stemmy condition of the pastures develops about November, and, stemmy pastures being eminently unsuitable for ewes and lambs, sheep that were thriving up to the appearance of stemminess in the feed soon cease to thrive.

From this it follows that as a rule the man who condemns top-dressing as a factor in profitable lamb-production has to face one of the following alternatives: Either his top-dressing has not been suitable to his conditions and has not produced enough additional feed to become profitable or the top-dressing has been effective enough and there has been failure in some other phase of the management of the farm so that the additional feed has not been used properly. In either case the poor result originates in poor management.

A Parallel Position in Dairying.

When the weather in spring and early summer has favoured rapid growth of pasture not infrequently the production of herds begins to fall in November or early December at a rate which is greater than is natural in satisfactory dairy stock being fed efficiently. Such an abnormal falling-off in production is almost always if not always, associated with the development of stemminess in the pastures. Stemmy pastures intrinsically are unsuitable for the feeding of cows of reasonably good productive capacity because heavy production is possible only in animals receiving a liberal supply of feed of high digestibility and the digestibility of the feed from pastures is greatly impaired as their stemminess due to an increased content of fibre increases. About 80 per cent. of the dry matter of leafy pasture-growth is digestible, whereas only from 40 per cent. to 60 per cent. of the dry matter of stemmy growth is digestible. Hence a given weight of the dry matter of stemmy growth may be only half as nutritious as the same weight of the dry matter of leafy growth and readily may provide inadequate nutriment for dairy cows over and above that required for mere maintenance to enable full productive capacity to be exercised.

Especially may poor results be expected in the case of pigs supporting themselves mainly on stemmy pastures; actually some of the poor results recorded from summer grazing of pigs may be attributed definitely to the stemminess of the pasture to which they had access. The ready way in which pigs react unfavourably to stemminess in pastures is due primarily to the fact that pigs are less fitted naturally to utilize feeds of low digestibility than are cattle and sheep—in the pig the volume of alimentary canal, in which digestion takes place, per 100 lb. of live-weight is much less than in cattle and sheep. Largely because of the comparatively restricted capacity of its alimentary canal or food tract the pig cannot utilize economically feeds of high fibre content; in this connection it is instructive to contrast coarse pasture growth having 20 per cent. of fibre in its dry matter with skim-milk from which fibre is absent and leafy pasture growth having approximately 10 per cent. of fibre in its dry matter.

Importance of Summer Control of Pastures.

The above considerations point unquestionably to a past common weakness in the management of pastures due to the fact that but little attention has been paid to the influence of the mechanical character of feed on the response of the animal when in feeding; this is actually of primary moment. A fact which obtrudes itself in practice is that in assessing the nutritive value of feeds for live-stock attention must be given not only to such matters as chemical constitution, vitamins, and minerals, but also to the physical or mechanical constitution of the feed. The extent to which the latter has been overlooked in our grass-farming has been very detrimental to returns; every pasture in which flowering stalks are prominent in summer is an instance in which the feed has deteriorated from the mechanical aspect of nutrition—its fibre content has increased and its digestibility has decreased correspondingly.

How to avoid stemmy pasture is a question which must be dealt with during the next few weeks. In dairying the measures that widely have proved decidedly valuable to this end are (1) suitable systematic grazing management; (2) adequate saving of silage and hay, and (3) topping of pastures with the mower.

Suitable systematic grazing is not at all difficult to carry out as may be gleaned from the fact that the essential steps in quite effective grazing on many farms have been :—

(1) Rapid grazing of fields by relatively heavy stocking Stocking at the rate of from six cows an acre upwards for periods of from one to three days has in practice given excellent results. The tendency definitely is for the best results to come from periods of only one day's grazing, which necessarily call for greater frequency in grazing than is advisable when the grazing-periods are of longer duration.

(2) Subsequent complete spelling of the pastures to allow of recovery sufficient to give the amount of grazing already specified. According to the rapidity of the pasture-growth spells of from about seven to fourteen days' duration have given good results.

Really close grazing of the pastures is at no stage necessary; in fact, it is undesirable. Hence suitable systematic grazing does not call for punishing treatment of either the pastures or the stock. Splendid results are being obtained on many farms on which nine to twelve paddocks are under grazing.

A most important aid to good results in systematic grazing is the immediate elimination, as far as is possible safely, from the grazing programme of all grassland additional to that needed to meet the current feed requirements of the stock Frequently poor results originate in failure to attend to this. The rational course is to save the feed from the fields dropped out of the grazing programme as silage or hay. A steady improvement in the Dominion in this matter is indicated by official returns which show that 536,000 acres were used for hay and silage in 1935-36, in comparison with 251,000 acres in 1927-28. A puzzling feature of the position is the decline in the ensilage acreage from a peak figure of 116,000 acres in 1932-33 to 83,000 acres in 1935-36. As a pasture-management measure ensilage is of outstanding value because it enables the disadvantages attaching to haymaking on account of unfavourable weather to be eliminated altogether. It is of prime importance to mow fields for hay or silage during the short period in which they are at the best stage of development having regard to the future production of the pasture and the feeding-value of the hay or silage. In ensilage, the farmer is independent of the weather; hence he may mow at exactly the best stage knowing that he can save the crop in good condition irrespective of the subsequent weather and that because of suitably early mowing he later will be rewarded with leafy aftermath which is likely to be especially valuable at just the stage when it becomes available and which almost certainly would not be produced at the time it is most needed following mowing delayed until the weather is good for haymaking. In short, efficiency in the matter under consideration depends basically upon the job being done at the right stage: ensilage enables the crop to be saved at the right stage without suffering otherwise in quality.

It being difficult to gauge exactly the area of grass needed to meet the feed requirements of the stock often some surplus feed arises in early summer on the paddocks not closed for hay or silage. Usually there is not enough of this feed to enable it to be conserved satisfactorily, but enough of it, if it is not dealt with, to spoil the control of the pasture-growth. When this is so it is as a rule advisable to check the development of coarse stemmy parts in a field by "topping" of the pastures—*i.e.*, by mowing to remove flower-heads. In this the mower should be set high. Close-mowing if followed by droughty conditions may lead to drying of the pasture and so have a decidedly undesirable result; in addition, it wastes feed. Frequently topping is deferred until it is so late that it is possible to obtain only little, if any, benefit from it. The primary objective in topping is the removal of flower-stalks and coarse growth, and the sooner these are removed after their development the better is the result.

Up to the present the three practices just discussed—systematic grazing, ensilage, and topping—have been employed with success most commonly on dairy-farms. Some farmers, however, have employed them with outstanding success on sheep-farms, and thereby demonstrated that on many sheep-farms, though certainly not on all, more could be done, and this with attractive profit, than is being done to secure such control of the growth of pastures during the early summer as would result in less stemmy and more digestible feed for ewes and lambs.

The Mangel.

Judging from advice to hand regarding sales of seed last year, there was an appreciable decline in the Dominion acreage of mangels. In some instances farmers may have been justified in reducing the area devoted to mangels or even in dropping the crop from their programme of feed provision, but in general an increase instead of a decrease in the Dominion acreage of mangels would be distinctly profitable. While exact comparisons between feeds so different in character cannot be carried very far with safety it is interesting to note that on the basis of their nutritive value mangels are worth about £1 a ton when compared with pollard at the present price in the North Island. Yields of 60 tons and over of mangels an acre are quite frequently obtained. The mangel is especially reliable, because it is subject to no serious disease or pest, and because when it receives reasonably good treatment it is able to stand a dry period comparatively well. The variety Prizewinner Yellow Globe is more widely grown than any other, this being the result largely of the consistently good yields of this variety which have been recorded over a long period. Other varieties of known good value are Red Intermediate, White Sugar, and Jersey Queen. The standard practice continues to be to sow about 6 lb. of seed an acre in rows 26 in. to 28 in. apart. There is a limited amount of field evidence which points to the practicability of obtaining greater yields by sowing in rows closer together (*e.g.*, 20 in. to 22 in. apart) and using heavier seedings (*e.g.*, 8 lb. an acre), but the amount of this type of evidence available, while suggestive, is not conclusive. Cold, wet conditions tend to cause loss or stunting of seedlings, and therefore sowing should not be done before warm conditions in the soil may be expected; over wide areas sowing before November is not advisable.

The mangel responds profitably to preparatory cultivation, which brings about a fine, firm seed-bed, and the best and cheapest way of obtaining such a seed-bed is to begin the job well ahead of seed-sowing.

The manurial needs of the mangel vary with soil and climatic conditions, but field results have shown that as a rule good returns may be expected from the use of a dressing of 5 cwt. to 6 cwt. an acre of a mixture consisting of equal parts of superphosphate and blood and bone or three parts of superphosphate to two parts of blood and bone. In districts in which benefit has been obtained from the use of potassic fertilizers the use of 2 cwt. to 3 cwt. of kainit an acre is likely to prove profitable.

Good treatment for the mangel in respect to both cultivation and fertility is specially advisable, and if the probability of giving the crop good treatment seems small, then another less exacting crop such as swedes or chou moellier should be grown. But the mangel responds so strikingly and profitably to good treatment that it should be grown much more widely whenever it is possible to meet its needs. Because of the really heavy yields of which it is capable it is especially suitable on costly land—it enables the heavy fixed charge of rent or interest on the land to be more widely spread.

Causes of Inefficient Ensilage.

Unfortunately, a good deal of inefficiency characterizes ensilage in New Zealand. In addition to failure to utilize up-to-date labour-saving equipment and means of storage—*e.g.*, trenches and pits—among the main causes of inefficient ensilage are :—

(1) Too late mowing of the crop, which, as a rule, leads to a falling-off in quality that substantially outweighs any increase in quantity. The material resulting from too late mowing is unduly stemmy or woody, and this, irrespective of the curing process, is associated with the poor balance in the supply of nutriment and the low digestibility that characterizes any over-mature pasture-growth.

(2) Curing at excessively high temperatures, which results in avoidable loss in feeding-value. This often may be remedied by more speedy ensilage. Partial-wilting of the material tends to lead to high temperatures, but in dealing with very sappy material partial wilting may be advisable. As a rule, additional green material should be placed upon that already gathered as soon as the latter begins to sink in height because of the curing process. If this rule is followed temperatures in the vicinity of 100° F. will develop and silage of a greenish to a yellowish tint usually will result.

(3) Insufficient exclusion of air, which leads both to too high temperatures, resulting in silage which is too dark and in wastage due to decay. This fault may be removed or lessened by more thorough packing in the pit or trench and by more adequate covering of earth or other sealing-matter, which, to minimize wastage, should usually be placed in position practically as soon as all the green material has been gathered. It is more difficult to exclude air sufficiently from stemmy than from leafy green material, and because of this late mowing tends to less efficient curing and more wastage.

—*R. P. Connell, Land Utilization Officer.*

THE ORCHARD.

Pest and Disease Control.

THE effective control of pests and diseases in the orchard will be the chief concern of orchardists for the next month or so, and it will be necessary to be on the watch for the first appearance of disease, so that early and appropriate measures may be taken. Showery weather, with warm spells intervening, is usually experienced at this period of the year, making it more difficult for the orchardist to apply the respective sprays at the proper times. It should also be remembered that such weather is favourable for the spread of fungous diseases, and at the same time insect pests will also be on the increase. Of the fungous diseases, black-spot is probably the chief consideration in most orchards. Growers should anticipate an attack rather than wait until the disease makes its appearance on foliage and/or fruit—to obtain success the treatment must be preventative and not curative.

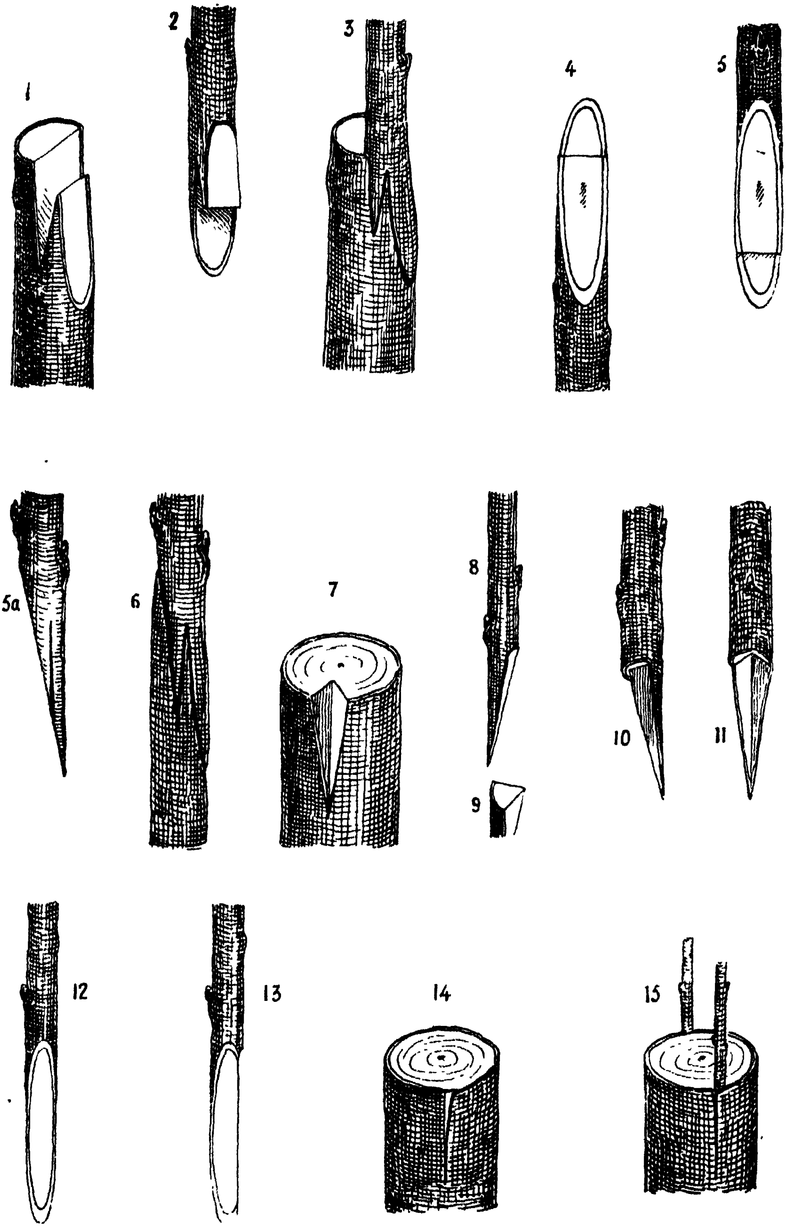
The advice given in the last month's notes in the *Journal* should be carried out as far as climatic conditions will permit. Should rain follow before the spray has had a chance to dry on the trees it will be necessary to repeat the operation as soon as possible to replace the protective film of spray. From now on growers will be using specifics in combination when applying sprays, and care must be exercised to avoid damage being done to either foliage or fruit. While the application of sprays usually costs more than the materials used, and the combining of two or more sprays is an advantage, three factors should be kept in view—(1) disease-control, (2) injury to tree, and (3) russeting of the fruit. On some of the tender-skinned varieties the use of colloidal-sulphur in place of lime-sulphur is recommended after the " petal-fall " period, but growers will have to be guided in their choice of these specifics by weather-conditions ruling at the time. Tests carried out with lime-sulphur at strength, 1 per cent. polysulphide content (1/150), plus colloidal-sulphur at 2 lb. per 100 gallons of spray, have proved very effective for the control of black-spot ; in fact, in many cases the results have been better than where lime-sulphur was used alone, and the risk of russeting the fruit has been minimized. There appears to be very little advantage in using a spreader in sprays to which colloidal-sulphur has been added. Where there is a risk of damage to foliage or fruit from the use of lime-sulphur during the early summer period it is preferable to switch over to the combination or even use colloidal-sulphur alone. Whichever spray, or sprays, it is decided to use, the closest attention should be given to thoroughness of application, correct measurement of ingredients, and complete coverage. It is only by attention to these matters that an effective control may be secured.

Cultivation.

The continuation of the cultivation of the orchard should not be neglected, as it is only by repeated stirring with either harrow or cultivator that the soil can be reduced to that fine state so necessary to produce a satisfactory soil-mulch. Hoeing round the trees, if it has not already been attended to, should receive attention before the soil becomes too hard. This orchard practice is not only very beneficial to the trees, but is the means of destroying any volunteer growth and trash which provides a good breeding-place for pests and diseases. Light cultivation by means of disks, scarifier, or other means at convenient intervals throughout the season has a great influence on the quality of both foliage and fruit and should therefore receive the attention due to it.

Grafting.

During the past two or three years an increased number of apple-trees have been reworked to other varieties. It is still being carried on extensively, as growers have come to realize that it is not profitable to grow varieties that do not even pay ground-rent. The question of which varieties to work is an important one, consideration having to be given as to whether the new variety is required for the export or for the local market trade. Some consideration should also be given to varieties already grown in the orchard, whether early or late, dessert, or cooking, coloured or green, susceptibility to disease, &c., and whether the resultant crops are likely to find a ready market. The tendency should be to decrease the number of varieties grown rather than increase them. Therefore before starting grafting operations full consideration should be given to these points ; it may save disappointment in the future. Grafting is not a difficult task, although several points have to be kept in mind. Even with the greatest care it is not always possible to get 100 per cent. take, especially if the scions have not been kept in a dormant condition or the buds are in an unhealthy state. Some growers have been inclined to leave the grafting until the weather becomes hot and dry, and then wonder why " the take " has not been up to expectations. Accuracy in cutting, both scion and stock, has a great influence on the results obtained, whilst neatness of work should be the aim of the operator. If these important details are attended to, the union between stock and scion will soon take place, and then the buds on the scion will break into growth. The method usually employed is known as " bark " or " rind " grafting, although on occasions, if the stock



GRAFTS.

1, 2, 3. Whip graft for use when stock is thicker than scion.
4, 5, 5a, 6. Whip graft for use when stock and scion are equal in thickness
7, 8, 9. Notch graft : scion for old trees, and section of scion.
10. Improved notch scion with shoulder.
11. Front view of No. 10.
12, 13, 14, 15. Rind graft (Fig. 13 showing scion with square edge).

is not too thick, the " whip " graft may be used ; but, whichever method is adopted, it is imperative that the fit be perfect as possible, and that the scions be securely attached to the stock, either by means of a small tack or by tying with raffia. The whole of the cut surface must be thoroughly waxed, either with a home-made grafting-wax or with one of the proprietary compounds which are now available on the market. The thorough covering is most important, and should not be neglected, as exposed surfaces offer ready entrance for disease.

The reworking of fruit-trees by the introduction of grafts along the branches, instead of the older method of cutting the tree down to clear the base of the limbs and then grafting, has gained a certain amount of favour recently. There are many points in its favour, although it is a long and tedious operation, and therefore more costly. When one considers that as many as 150 grafts might be inserted along the branches of one tree, the time taken to graft an acre or two would be great. One of the chief advantages with the " porcupine " system is that a full-bearing tree is obtained sooner. Whether this compensates for the extra time taken is questionable. By this method leaders not required in the future tree are cut out, the balance being bared of growth with the exception of any side laterals suitable for grafting. The branches are cut down to the required height and grafts are inserted at regular intervals, taking advantage of any side laterals in a convenient position. A graft is also inserted in the top of each of the leaders. The whole of the cut surfaces are covered with grafting-wax. During the growing season many laterals will grow from the original tree. These can be utilized by inserting buds in February should any of the scions fail to grow, otherwise they must be suppressed.

Fireblight.

Growers are advised to keep a sharp look out for fireblight infection. The disease may be discerned by the discoloration of the blossoms which continue to hang on the trees and by the sudden wilting of new shoot growth. It is mainly through the blossom that the disease spreads to the growing tips of the laterals, and then down the laterals to the main branches. The spread of the disease may be very rapid, enveloping the whole tree if uncontrolled. All affected parts should be cut out below the visible point of infection and destroyed immediately. The secateurs should be sterilized with formal-alchol (commercial formalin 6 cc., alcohol 95 per cent., methylated spirit 94 cc.) after every operation. Any suspected specimens should be submitted to the Orchard Instructor for the district for examination.

The wounds should be treated with acidulated mercuric chloride solution (mercuric chloride 1 gram, hydrochloric acid concentrated 15 cc., water 500 cc.). The solution should be held in glass or earthenware container. It is highly poisonous and should be labelled conspicuously " POISON." It should not be left lying about.

—*George Stratford, Orchard Instructor, Motueka.*

Citrus Culture.

Pruning.—Citrus trees can be pruned at any time of the year except during their winter period, but the most suitable time is in the spring, when the danger of further severe frosts is past. There is no fixed style of pruning for citrus trees that can be claimed to be generally suitable for adoption in all orchards nor for any individual orchard, as every orchard and every tree has its particular requirements in the way of pruning. The need for this variation of treatment is much greater in citrus than in any other class of fruit-trees. The pruning, however, should be sufficient to maintain a fairly open-headed tree furnished with a good supply of thrifty fruiting-laterals. A systematic pruning at the time of planting is, however, of the utmost importance. Trees should then be pruned in much the same manner as deciduous fruit-trees, from three to four branches being selected to form the framework. The branches should be arranged spirally on the trunk and not opposite each other. The lowest branch should be at least 2 ft. from the ground. All branches that are not required should be removed. These framework branches need not be shortened provided they are of equal vigour, have not been injured by frost or other causes, and are not exceptionally long. During the following three years frequent light prunings are necessary, particularly for the purpose of removing superfluous shoots and crossing branches. Any branches which are growing vigorously to the detriment of others should be frequently pinched back to give the tree a balanced head.

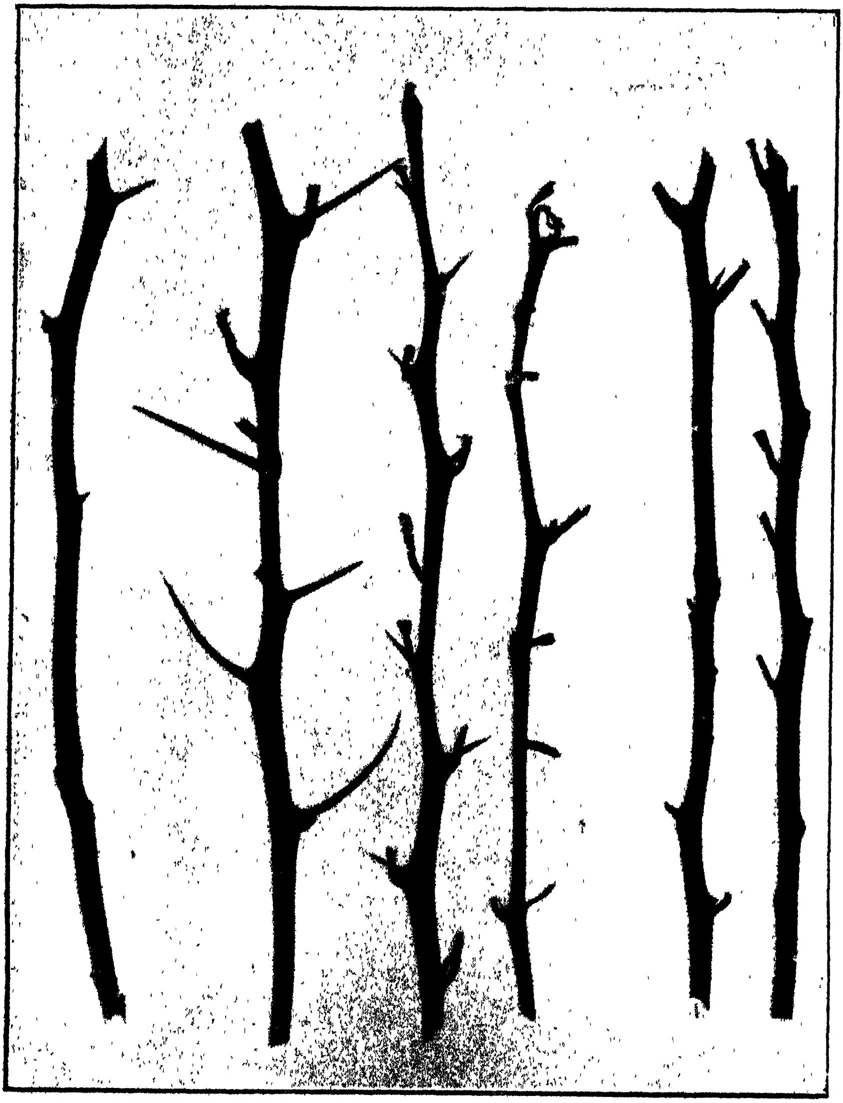
In later years much greater variation in the treatment of individual trees is necessary. It is not possible in these notes to describe all of these treatments. Probably the three most important aspects of pruning mature trees are—(1) the maintaining of a fairly open head, (2) the reinvigorating of fruiting-laterals, limbs, and even entire trees that show signs of lacking full vigour, and (3) the removal of all dead wood. The degree of severity with which to prune must vary, according to circumstances, from a removal of spent fruiting-laterals, as is frequently found in the interior of lemon-trees, a shortening-back of branches and strong lateral growths to cause them to send out fruiting wood nearer their base, to a complete skeletonizing of the entire tree in cases of extreme debilitation. It is also important that shoot-growth killed by frost should be removed as soon as the danger of further frosts is past. All cuts more than ½ in. in diameter made in pruning should be covered with a wound-dressing of the bitumen-emulsion type.

Manuring.—If the spring dressings of fertilizers and manures have not yet been applied, this work should be put in hand as early as possible, as it is now becoming late for such applications. Where available, farmyard manure of any kind should be given preference, and this can be supplemented by a quick-acting nitrogenous fertilizer such as sulphate of ammonia. Annual dressings of blood-and-bone manure at the rate of 8 lb. to 12 lb. per tree is giving good results.

Budding.—If it is intended to rework citrus trees the budding should be proceeded with as early as possible to ensure satisfactory growth during the current season. In selecting budwood it is important that only well-matured wood should be used. Plump shoots of the type that usually produce fruit give the best results. Flat or angular growth is undesirable. Different types of citrus budwood are shown in the accompanying illustration.

Verucosis.—In some instances growers do not appear to realize that the rough condition of the rind of their fruit is due to this disease. The fruit is most susceptible to infection about the time the first blossoms are shedding and while the fruit is quite small. The most dangerous period for infection is when the fruit of the main crop is setting. In orchards where the disease has become established three applications of Bordeaux-mixture spray at a strength of 3-4-50 are recommended as follows: (1) When the earliest fruits of the main crop are setting; (2) Repeat three to four weeks later—this repeat spray is very necessary; (3) a spraying during the autumn blossoming-period is also required to ensure a clean crop. Where black aphis or scale insects are troublesome it is good practice to add summer-oil at a dilution of 1–1000 to the Bordeaux sprays. Where black aphis is the only insect troublesome at the time, nicotine sulphate, 40 per cent., can be used in the place of summer-oil at a dilution of 1–800.

Cultivation.—The surface soil should receive cultivation sufficiently frequently, for the next few months at least, to prevent a crust forming on the surface of the soil and to retard the growth of weeds. There is a tendency on the part of many growers to cultivate to a depth of 8 in. to 10 in., particularly on the light pumice soils. This practice of deep cultivation is believed to be responsible for the general unhealthy appearance of many citrus orchards. A tilth of from 3 in. to 5 in. is all that is required in most types of soil, and deeper cultivation is liable to destroy valuable feeding-roots without offering any advantage.



DIFFERENT TYPES OF ORANGE BUDWOOD.

On left, old and blind type; two in centre, flat and angular type; two on right, desirable type.

—*P. Everett, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

Preserving of Eggs.

ALTHOUGH much has been accomplished during recent years by improved methods of poultry-keeping to bring about a greater production of fresh eggs during the winter months, it may still be said that eggs are a seasonal product.

The average monthly production of a good flock of first-year leghorns should be in the vicinity of the following: April, 22 per cent.; May, 51 per cent.; June, 52 per cent; July, 58 per cent., August, 65 per cent., September, 74 per cent., October, 75 per cent; November, 68 per cent.; December, 64 per cent.; January, 56 per cent.; February, 55 per cent.; March, 32 per cent. Owing to this uneven seasonal production, which results in a surplus during the spring months and a shortage during the late autumn and winter months, it is an economic proposition to preserve eggs during the flush season for use during the off periods September, October, and November are the months of greatest production, and eggs naturally cost less to the consumer then than at any other time of the year, and a good saving may be effected in the home if householders preserve eggs when cheap for use during the scarce and dear season. Apart from the fact that eggs are cheaper, the spring and early summer are the best times to preserve, for, generally speaking, eggs produced at these times are of better quality and possess better keeping-qualities than those produced during the hot weather.

Those intending to preserve should lose no time placing down their requirements Only fresh, clean, and sound-shelled eggs should be preserved, as one or two dirty, cracked, or musty eggs may spoil the lot. For this reason all eggs should be tested for cracks and internal quality before being placed in preservatives

To test for cracks take an egg in each hand and gently tap them together; if the shells are sound they will give a true ring, but if one is cracked the sound will be dull and quite different.

Examination for internal quality can be made by the use of a tester and by holding the eggs to a strong light. By this method any defects can be detected at once. A simple tester can be made from heavy brown paper, such as illustrated on page 52 of the Department's Bulletin No. 66, "Utility Poultry Keeping," a copy of which may be obtained from the Publisher, Department of Agriculture, Wellington, at a cost of 1s, postage free.

It is advisable to allow the animal-heat to get out of eggs before they are placed in solution; as an instance, eggs laid to-day would be better if kept in a cool place for about twenty-four hours before being placed in preservatives. Thoroughly clean jars, crocks, or tins should be used to preserve eggs in, and these vessels should be kept in a cool dry room with plenty of ventilation.

There are several useful mixtures and brands of preservatives on the market. Some householders put eggs down in dry salt or even bran. A lime-water solution is sometimes used, made up of 4 measures of fresh, finely slaked lime mixed with 20 parts of water and 1 measure of salt. The whole is well stirred together a day or two before using; the clear liquid is then poured off and the eggs placed in it. A more popular preservative and one used with almost universal success is water-glass (silicate of soda); this material is sold by most chemists and grocers for the purpose. The water-glass should be diluted just enough to allow the egg to sink, say, from ten to fifteen parts of water to one of water-glass according to its strength. The water should be boiled and allowed to cool before mixing in the water-glass. Eggs may be added from time to time until the vessel is full, but at least an inch of the solution should cover the top layer of eggs. When the vessels are full they should be covered over in order to prevent evaporation of the solution.

Eggs should be washed when taken from the preservative and if they are to be boiled it is advisable to prick the thick end, otherwise expansion is likely to cause them to crack.

October Brooding.

October-hatched chickens are, as a rule, much more difficult to rear artificially than those hatched earlier. Especially is this so if the weather is warm and muggy nights are experienced.

Efficient management and close attention to all little details is required to make a success of the later-hatched chickens. It frequently happens that the poultry-farmer has so much to do at this time that he is unable to give that extra time to the last batch of chickens, which often means so much for their welfare.

The chief essentials to successful artificial brooding are proper warmth, a constant supply of fresh air, ample room under the hover, dryness, and cleanliness. Poultrymen of experience seldom use a thermometer when brooding chicks as they depend upon the action of the birds to indicate whether the correct temperature is being applied. There is with some a tendency to use the same amount of power or flame during October as previously used during the colder months, resulting in the chicks being compelled to sleep in an overheated atmosphere, and consequently they do not thrive. Where the beginner is not satisfied with the progress being made by his chickens he would be wise to place a thermometer under the hover about an hour after the brood has camped for the night, and the cause, or one of the causes, of unthriftiness may be detected.

The trouble known to poultrymen as " green-leg " or " green-wing," the chief symptoms being a swelling of the head, neck, and hock joints, often makes its appearance about this time of the year. It is really the result of incorrect night conditions such as overcrowding of the brooder, lack of proper ventilation causing the chicks to breathe the impure air, a condition which also causes the bedding to become damp when a moist atmosphere is created. Treatment for this trouble is of little avail; it is more a matter of prevention.

If a frame is not used to brood the chicks in, as recommended in Bulletin No. 66, " Utility Poultry Keeping," one should be installed. When a frame is in use care must be taken to see that the netting or sacks are tight so that no pockets or hollows are created to encourage the chicks to huddle together; plenty of dry, clean bedding-material should be provided, as a little extra depth of bedding will often help to prevent huddling. Visit the chicks just as they are camping for the night and see that they do not cluster together. If they show a tendency that way they should be gently spread out, and it is advisable to stay and watch them until they have settled down for the night. When the canopy type of brooder is used it is a good idea to very gently lift the hover a little, after the birds have settled down. Above all, avoid overcrowding; in fact, place fewer chicks together as the weather becomes warmer. The cockerels should be picked out as soon as possible and allow the extra room for the pullets.

Well-brooded Leghorn chicks should be ready for perching between six and seven weeks old, but they should be hardened off gradually. It is well to make sure that plenty of trough-feeding space is available so that all birds can feed at once.

Green Foods.

It is true that chickens and fowls may be kept without green food, but there is a big difference between those that are given a regular supply and those that are not. Green food seems to put new life into the stock, but it should be fed regularly, at least twice a day to chickens and at regular times, otherwise they are likely to gorge. Provision should now be made for a regular supply of green food for the coming months, as no poultry-farmer can afford to be without a good, green food-patch for his birds.

Chick-sexing Examination.

A chick-sexing examination was held at the Wallaceville Poultry Station on Thursday, 26th August. Six candidates presented themselves for examination, one for a first-class certificate, two for renewals of their second-class certificates, and three for second-class certificates

Mr. W. H. Barnes, who sexed 50 chickens in ten minutes, with an accuracy of 96 per cent., qualified to have his second-class certificate, which he gained on the 4th November, 1935, renewed.

Mr. J. C. Jamieson, who sat for a first-class certificate, but failed to qualify, sexed 200 chickens in twenty-five minutes with an accuracy of 92½ per cent His second-class certificate, which he gained on 27th August, 1936, will be suitably endorsed.

The idea of the endorsement of an existing certificate is to show that the person concerned is in practice and able to operate with a good degree of proficiency

—*C J. C Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Food-supply.

In districts devoid of native bush, where the bees are practically dependent on the flora found in the open paddock, it will be necessary to keep an eye on the food-supply during November. Willows, dandelion, and fruit-trees will have ceased to bloom, and while there will be a little clover in flower this is not likely to secrete nectar. Clover is very susceptible to climatic conditions, and the right conditions for its secretion of nectar do not usually prevail until the end of November or early in December. Hawk-weed and cape-weed will then be in full bloom, so in districts favoured with abundance of this flora there should be a good flow about the time stated. In the meantime care should be taken that the bees are not allowed to starve—it is a critical stage in the life of the colony.

Swarming.

Given reasonably fine weather some colonies will have become very strong and, unless steps have been taken to prevent it, overcrowded and inclined to swarm. It is best to keep down swarming as much as possible, and to make any increase desired in anticipation of the natural tendency. If no increase is desired, the simplest way to keep down swarming is to provide the bees with plenty of room and offer them inducement to avail themselves of it. This is best accomplished by giving them a super containing, for preference, nine combs—assuming that it is a ten-frame hive we are dealing with—the centre comb being a frame of brood lifted from the brood chamber and replaced by an empty comb. It is not sufficient to merely place the super of empty combs over the brood-chamber; the frame of brood must be lifted and placed in its centre. Where half-depth supers are used this is not practicable; in such cases it is advisable to make a practice of carrying over some partially filled combs from year to year. Even when it is intended to produce section honey it is best to draw the bees first into a super of ordinary combs. When the bees have become accustomed to working in the super it can be removed and a rack of sections substituted.

Despite every precaution, however, the bees will sometimes swarm. It will not be a very serious set-back to the apiary if a few colonies do each cast one swarm, but after-swarms must be prevented as far as possible. The first swarm will be headed by the old queen, and will, given fine weather, come off as soon as the first queen-cell is sealed. Swarms, especially those headed by a laying queen, almost invariably settle within a few minutes close to the apiary. It is not safe to reckon on the bees remaining long at their first resting-place, however, especially if this is a sunny situation; they may rise again within ten minutes and fly for miles before again settling.

To take the swarm procure a benzene-case or similar box and hold under. If the bees have settled on the branch of a tree shake them with a vigorous jerk of the branch into the box; when this is not practicable brush them in. Then as quickly as possible slip a bag over the box and turn it upside down, placing a stick or stone under one corner to provide an opening for the bees. Leave the bees in this box until at least 4 o'clock in the afternoon, then take them to the site of the prepared hive and, after placing a sack on the ground, shake out the bees immediately in front of the hive. In dealing with a swarm at an out-apiary where it is desirable to hive it at once it is a good practice to place in the centre of the hive a frame of open brood taken from an established colony. This will prevent the bees absconding. The greatest care, however, must be exercised to ensure that disease is not thus transmitted. In hiving a swarm under such conditions place an empty super on top of the prepared hive, take the swarm in a bucket, and then shake the bees into the super. The frame of brood in the hive below generally attracts the bulk of the bees downwards; the balance can then be brushed from the sides of the super, the super taken off, and the swarm taken in a few minutes to its permanent location in the apiary.

To check any further swarming look over every frame carefully and cut out all but one queen-cell. It is necessary to handle the frames as gently as possible; do not shake the bees off the combs lest the one remaining queen-cell is destroyed. There is a possibility that the bees may swarm out with the young queen when she takes her maiden flight. If this does happen, put them back again without fail.

General.

The hives should be rested on bricks or stands of some description, raising them about 6 in. off the ground. Place the bottom-board with a slight slope toward the front. Keep down the grass and weeds about the hive; a tangled entrance which hinders the exit and entry of the bees seriously affects the honey crop. If gable roofs are used, do not fail to use mats to prevent the bees building in the roof. Mats are not necessary with flat roofs.

—*E. A. Earp, Senior Apiarist.*

HORTICULTURE.

Vegetable Crops.

To produce good crops from seed, weeding requires close attention, especially while the crop plants are small. When the plants cover the ground there is less danger of their suffering a set-back owing to the competition of weeds for the available light, air, moisture, &c. Many crops are lost by being overgrown by weeds or only small crops are harvested at an uneconomical cost owing to the amount of labour spent on weeding. Serious weeds, such as couch-grass or twitch, are usually worked out of the ground before sowing, although not infrequently one finds a grower sanguine enough to sow or plant a herbaceous crop in ground infested in that way. Most of the weeds infesting a crop are from seeds in the ground which have been grown there, or have blown in, or have been brought in by birds. Stable manure, straw, or organic matter of many kinds that are ploughed under to enrich the soil may include weed-seeds unless the material is thoroughly fermented, when in most instances they are sprouted and destroyed during the process. After deep cultivation land that was considered to be clean sometimes produces a heavy growth of weeds from seeds brought up near the surface from below, where they have lain dormant for years. Such is the hardihood of some weed-seeds.

The labour and cost of weeding is greatly reduced if during the preparation of the land for sowing it is allowed to lie and settle down for a fortnight or so after deep and thorough cultivation has been given. This rest allows the weed-seeds near the surface to sprout, when they may be readily destroyed on a fine day by means of a shallow stroke with hoes. If the crop is then sown without further deep cultivation, which may bring up more weed-seeds, the labour of dealing with this problem is greatly reduced.

Thinning the crop is also a formidable undertaking with many growers. Where plants are crowded in the rows it is impossible to obtain a good crop unless they are thinned out, which, under the best conditions, is a tedious undertaking. This labour is almost entirely avoided by carefully considering the germination percentage of the seeds and the desired distance between plants. They may then be sown sufficiently thin in the row to produce a crop which will require little or no thinning out afterwards.

Weeding and thinning seedling crops should now be given prompt attention as required. Weeds should be destroyed while small before they produce rough leaves, during fine weather; and thinning should be done shortly after rain, when the young plants draw easily.

The shortage of organic manures makes it necessary, in most places, to carefully compost all available material. This means all animal and vegetable material which can be reduced to a thoroughly decayed state in about twelve months. This eliminates chiefly large bones and hardwood branches of any size, which are best burnt. The remainder should be built into a compact stack with perpendicular sides, in a humid shaded place, which are the conditions most conducive to decay. The method is to remove a foot of soil from an area 4 ft. to 6 ft. wide, and as long as necessary, piling the soil in equal quantities on either side. In this trench hedge-clippings, lawn-grass, house waste, fowl-manure, weeds, &c., should be built into a compact stack as it becomes available. About the time of the New Year the stack should be sealed by covering it with the foot of soil which was removed from the foundation

Where soil is required for seed-boxes, potting, and top-dressing a stack of sufficient size should now be built of the top-spit of old pasture with the grass downwards. If at the end of twelve months it is cut down, broken up, and restacked it should be ready, after two or three years, to form the main ingredient in a first-class compost for the purposes mentioned above.

Where grassland is to be broken in for cropping a commencement may be made now by ploughing it shallow, just sufficiently deep to get beneath the roots of the present vegetation and turn it upside down. When the turf has been killed, so far as possible, it should be cultivated and harrowed to enable all twitch and other perennial weeds to be gathered and burnt before deep ploughing, in readiness for planting a crop during the autumn. The summer season usually affords good opportunities for cleaning foul land in this way. If the operation is not completed, then it may be necessary to sow the land down thickly with a cover crop at the time of the first autumn rains, with a view to smothering any weeds which remain.

During the month of November the sowing and planting of the half-hardy crops mentioned last month may now be done in the cooler districts, also garden swede-turnips should be sown.

Small and Sundry Fruits.

For about three months during the Christmas period the main berry crops are ripe and mark the season of summer-time. Tree fruits are practically off the market, and a good demand can always be relied on for these attractive berries. Most of them are very perishable unless, for long distance shipping, they are picked in firm condition. Even when the greatest care is taken such fruit as raspberries depreciate badly if subjected to much delay and handling. For this reason the distribution of these crops requires careful consideration, and definite plans made before harvesting commences. Picked when dry, of even maturity, and packed in clean bright packages, nothing in its class is more attractive.

During the month of November tomatoes in the unheated glasshouse commence to ripen. Watering, feeding, and ventilation then require close attention to maintain health and vigour while the crop is developing. Just what this means will depend on the soil and subsoil, also the climate, especially as regards temperature and sunshine. With four or five bunches of fruit set, some nitrogen may now be included in the manurial treatments without fear of the plants bolting to rank growth, but, even so, moderate quantities at intervals of a fortnight are better than larger doses at longer periods. Where there is any doubt as to the most suitable prescription, the following mixture may be tried, and afterwards modified as may be found advisable from the reactions experienced in the plants: Dissolve ½ oz. nitrate of soda, 1 oz. superphosphate, and ½ oz. sulphate of potash to each gallon of water, and apply at the rate of about one quart of the solution to each plant the day after watering. Before the fruit commences to colour it is usually advisable to lay a mulch of strawy stable manure or clean straw to conserve moisture and prevent splashing when watering. At the same time the base leaves, up to about the first bunch of fruit, are cut away, carried out, and destroyed. Among other things, this assists the colouring of the fruit and improves the circulation of the air in the house.

The tomato-weevil has been reported recently as doing serious damage to this crop under glass. The mature larvæ of this insect are legless, light green in colour, and about ½ in. in length. They are active during autumn, winter, and spring, when they enter the ground and form an earthen cell and the pupa is formed. The adult is a typical weevil, slow-moving and nocturnal in its habits; it feeds on vegetables of many kinds and some weeds, destroying chiefly the tender crown leaves; but the attack of larvæ on tomato crops in spring is the damage which has chiefly come under notice here. The control of *Listroderes costirostris* (*Desiantha nociva*) is by means of thorough cultivation of the soil, especially during late winter and spring, when the insects are passing through the pupal stage and are easily destroyed; the Paris green or arsenic poison bait broadcasted before planting as for cut worms; and spraying the plants attacked with a solution of arsenate of lead.

During the month of November the planting-out of half-hardy crops, mentioned under this heading in notes last month, should be completed. If this is done with care there will be little check to growth and the crops will be earlier and bigger. To water the plants the day before transplanting is usually advisable. Disturb the roots as little as possible, and do not expose them unnecessarily to the air; plant firmly, deep rather than otherwise, and avoid injuring the base of the stem when firming the plant are some of the necessary precautions.

The Homestead Garden.

Everybody appreciates a garden even if they do not like gardening. Good tree-shelter breaking the force of prevailing winds and rain is of decided utility for those who have to spend much of their time outside and greatly facilitates the maintenance of suitable temperatures in the home, while deciduous trees, well placed, afford shade for property and stock during warm summer days, which is quite as valuable. These features, which necessarily include grassed open spaces of proportionate size, practically make up the garden, if areas for the production of fruit and vegetables are included. The selection of trees and shrubs for the above-mentioned purposes in any particular locality—their number, arrangement, and position—are matters requiring a great deal of consideration if it is to be done effectively without loss of time. In most instances it is the deciding factor, and where careful consideration is given generously the result is invariably good. In addition to one's own experience and preferences, it is advisable to carefully study the behaviour of mature trees and shrubs in the locality growing on the same class of soil, and under most circumstances it will be best to confine oneself to using only those which have proved successful. Decisions arrived at should be recorded in the form of a plan, to scale, on graph-paper with squares about ten to the inch. Each operation in the undertaking can then be carried out in season according to plan as opportunity offers.

Where gardens and gardening afford pleasure those living in homes in the country have special opportunities for the enjoyment of the art. Lawns may then be used for out-door sports, and an enclosed garden affords privacy and shelter for leisure moments, where, if garden seats are provided in shaded and sunny arbours, it will be popular with old and young at most seasons of the year. The summer period now commencing is most suitable for studying the problems connected with the construction of new gardens and alterations and additions to old ones, so that plans may be completed and ready for execution during the autumn months, which are perhaps quite the most suitable for that purpose.

Other work for the month of November includes the planting-out of half-hardy flowering annuals, dahlias, and chrysanthemums, also training and tying climbing plants, and plants in the herbaceous border. Common troubles which commence to make their appearance at this season are rose aphis and mildew. To keep the plants quite free from these troubles it is often necessary to spray them at regular intervals, and an early commencement is a great advantage. For the control of mildew some form of sulphur is the best remedy. The most generally useful probably is lime-sulphur, one part to fifteen of water applied as a fine spray in autumn, as soon as the leaves fall, and again just before growth commences in the spring. At the present time colloidal sulphur 2½ oz. to 4 gallons of water is best, or potassium sulphide, 1 oz. to the gallon, may be used. For aphis-control any contact insecticide will destroy them—nicotine sulphate is commonly used—but owing to their wonderful fecundity reinfection soon takes place in fine weather, and spraying must be repeated , where the attack is persistent a weekly application is sometimes necessary.

—*Wm. C. Hyde, Horticulturist, Wellington.*

A farmer of Tirau who owns a farm of 340 acres, carrying-capacity 1,300 breeding-ewes and from 180 to 200 head of cattle, has had good results with basic slag in top-dressing this past season. When growing root crops and sowing down permanent pasture his manurial treatment is equal parts of super and bones at the rate of 3 cwt. per acre. When old pasture is ploughed for root crops he applies 12 cwt. of carbonate of lime on the furrow. His usual top-dressing mixture is one sack of superphosphate (1¾ cwt.) and 1 sack of lime (1 cwt.) per acre. Last autumn he top-dressed part of his farm with basic slag at the rate of 3¼ cwt. per acre and the usual super-lime top-dressing on the remainder. The lambs from the ewes on the slagged country were all sold and forwarded to the freezing-works on the 20th November in one line ; late lambs doing very well. Only one-third of the lambs from the super-lime top-dressed country were ready and sold at this same time.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SPECIFICATIONS AND COST OF A SHEEP-DIP.

P. G. A., Tirau :—

Could you supply me with the specifications and cost of a sheep-dip to deal with three or four hundred ewes ?

The Live-stock Division :—

You have not stated which particular type of dip you favour, but as the " pot " bath is by far the most common in small sizes we will assume you favour this type. The sizes given are about the minimum economic size to build, as anything smaller will be too slow to work. A larger bath (which you would be well advised to build if you are anticipating an increase in the size of your flock) will be more expensive for first cost and in the fluid left unused at the bottom after dipping, but, on the other hand, will be correspondingly quicker and easier to work. The usual shape for this type of dip is conical like a gigantic flower-pot, but as the boxing required to mould the concrete is rather difficult to shape in the circular form, the average farmer will find it much easier and just as effective to make the bath square with the extreme corners removed This will do away entirely with any curves, and the boxing is then a straightforward job. You will find suitable dimensions to be: (*a*) In the case of a round dip, 6 ft inside diameter at the top, and 3 ft inside diameter at the bottom; vertical depth, 5 ft. (*b*) For a square dip, 6 ft. square at the top and 3 ft square at the bottom; vertical depth, 5 ft. The corners are cut off 1 ft. from each extreme corner—*i.e.*, a plank 17 in. wide is used to block off the corner. In each case the exit commences 1 ft. (vertical measurement) from the bottom of the dip and rises on an easy slope for 11 ft. (The horizontal measurement at ground level of the exit from the top inside rim of the bath is 9 ft.) The exit has a surface width—*i.e.*, at any point along the top—of 20 in.; the sides sloping down to a width of 12 in. (inside measurement) at the bottom. The same exit is used with either circular or square bath, and is provided with a vertical sliding wooden gate, preferably counterbalanced, where it leaves the dip The capacity of these two dips when filled to within 6 in of the top (this amount of freeboard is necessary) is approximately 620 gallons for the square dip and 550 gallons for the round one. In each case the bath is built of reinforced concrete. Two draining-pens should be provided, each measuring about 10 ft. by 30 ft., as this will mean that while one is being filled up the sheep in the other will have had time to drip sufficiently. These pens should be floored with 3 in. reinforced concrete on a gentle slope, and all run-off should return to the bath via a sump and strainer to catch the dirt, and enter the bath well away from the sheep exit. With prices fluctuating as they are to-day, it is impossible to give even a reasonably exact estimate of the cost, but most firms interested in this work would be willing to give an estimate.

VALUE OF CLUSTER PINE (PINUS PINASTER).

L. J., Taotaoroa, Cambridge :—

I have on my place, coming up very thickly, groves of the Pinaster pine, commonly known in the locality as wild pine. They are spreading very fast over country which can easily be brought into grass. I had decided to cut them, all except those on the steep faces and clumps and wind-breaks that would form good shelter. As they range in size from 2 in. to 12 in. in diameter and are in places as thick as 12 ft. apart, the task is likened unto bush-felling. Before I go much further I would like to have an expert opinion on the potential value of the Pinaster pine. Hitherto I have understood them useless and that grass would pay much better, but as the job is likely to be big in cutting them, I would like to make sure they will be no use in the future. The trees are extremely fast-growing. Five years ago they were just above the fern.

Horticulture Division :—

The planting of cluster pine (*Pinus pinaster*) is usually confined to seaside planting, where it makes useful shelter As a timber tree it is of less value than *P. radiata* and others, but as it is established on your place and doing well the proposal to use it as shelter and, say, firewood, as you suggest, seems appropriate. The question of its timber value here, and whether it should be allowed to grow on land easily brought into grass, is best referred to the Forestry Department. The inquiry should be addressed to " The Director of Forestry, State Forest Service, 47 Fitzherbert Terrace, Wellington, N. 1."

SOWING OF CHOU MOELLIER FOR MAY FEEDING.

E. R., Wairoa (H.B.) :-

I am thinking of sowing a paddock of 6 acres, which carried a crop of turnips last winter and was fed off by sheep, in chou moellier this spring for feeding off by sheep in May, and should be very glad if you could give me the following information : (1) The best time to sow ; (2) quantity of seed to sow through a drill per acre, (3) distance between rows ; (4) the most suitable fertilizer and quantity per acre. I presume that thinning is not necessary Could you also tell me if there is more than one variety of chou moellier, and, if so, which is most suitable for sheep.

Fields Division :—

Taking your questions numerically, I answer them as follows : (1) If you wish to feed off in May the seed should be sown in early November ; if you were to sow any earlier it would probably run to seed before you were ready for it, (2) and (3) 2 lb of seed to the acre is the usual practice, sown in drills 14 in. apart (every other coulter) ; (4) sown as above, 3 cwt of super or neutralized ammoniated super to the acre Chou moellier is a very gross feeder and thrives best on land where well-rotted farmyard manure has been ploughed in and plenty of nitrogen is available. Hence the value of ammoniated super Very good results have been obtained by first of all giving a top-dressing of 3 cwt. of ammoniated super, followed by drilling in the seed with a further 3 cwt of super On heavy clay land it is advisable to top-dress with half a ton carbonate of lime before sowing. It is important to obtain a quick establishment before the dry weather sets in, because, even should the plants be denuded of leaves by parasitic attack, the stems will throw out fresh growth in the autumn It is most important to plough early and cultivate the land deeply and thoroughly.

WEATHER RECORDS: SEPTEMBER, 1937.

Dominion Meteorological Office.

NOTES FOR SEPTEMBER.

SEPTEMBER was a rather mild month with little storm activity and generally an absence of extreme temperatures. Though the rainfall was considerably below normal over a large part of the country, skies were dull in these areas and there were few drying winds. Over most of the country, and especially the North Island and Marlborough, the rain was sufficient to keep the soil moist. In most districts there has been a good growth of crops, pastures, and other vegetation, but continued dull and wet weather has had a retarding effect in parts of the North Island and in Marlborough. Dry conditions prevailed, however, in most of Otago and South Canterbury, and good soaking rains will be required soon over much of the Dominion, especially if many dry north-westerly winds are experienced. Stock are in good condition, and the weather has, in most places, been very favourable for lambing. There were some losses owing to excessive rain in Marlborough at the beginning of the month and in Canterbury owing to cold towards the latter end. A rather severe frost occurred in Hawke's Bay and the Manawatu on the 29th, and considerable damage was done to stone fruit and tender crops.

Rainfall.—Conditions as regards rainfall were rather varied over the North Island. Rain was frequent, but many of the falls were light. In the Poverty Bay and Bay of Plenty areas totals were considerably below average, but in most of the Hawke's Bay and Wellington Provinces above it. In the South Island most of Marlborough and North Canterbury had more than the average, but the remainder generally less. Very little rain was recorded in Central Otago.

Temperatures.—Temperatures differed very little from the average for September and the departures from normal showed little regularity. Though the frost of the 29th was severe in the southern portion of the North Island there was no occasion on which severe cold was general. The nights, for the most part, were mild. Where the temperature was below average it was generally due to the prevalence of cloudy skies and low day temperatures. The temperature of the soil is higher than usual for the time of year.

Sunshine.—In the Auckland and Taranaki Provinces the amount of bright sunshine was, at many places, slightly above average. Except at Invercargill, where there was only a slight deficit, the month elsewhere was one of the least sunny Septembers hitherto experienced. Tauranga had 190·3 and Hamilton East 185·1 hours.

Storm Systems.—During the first eight days conditions were unsettled. Several rather indefinite depressions affected the Dominion, culminating in a shallow cyclone which moved from the west across the North Island between the 5th and the 8th. Frequent and widespread rains occurred over the North Island and eastern districts of the South. The western and southern portions of the South Island, however, experienced very little. Temperatures were mild. A number of thunder and hail storms occurred in the North Island.

After a brief spell of anticyclonic conditions and fine weather a series of westerly depressions passed between the 10th and 15th. There were some opportune heavy rains in Westland, where a shortage of water for mining and other operations had been experienced. On the 12th westerly gales blew at numbers of places, and on the 14th some snow fell on the ranges of the South Island.

Fine weather prevailed from the 16th to the 19th. On the 20th another series of depressions commenced, including a shallow cyclone which crossed the Cook Strait area on the 22nd and was followed by strong southerlies on the 24th. Heavy rain occurred in the central provinces. There was cold weather from the 23rd to the 25th, especially over the South Island, where snow fell in places.

On the 27th a rather unusual type of westerly depression crossed the southern portion of the South Island and as it passed a southerly change moved rapidly over the Dominion, gales blowing in the South Island. Snow fell on most of the ranges and there was thunder and hail in places. A similar depression was passing at the end of the month.

RAINFALLS FOR SEPTEMBER, 1937.

Station.	Total Fall.	Wet Days.	Maximum Fall.	Average September Fall.	Total Fall to date.	Average Fall to date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	5·59	20	0·91	4·90	49·93	43·66
Russell	2·70	16	0·60	4·98	84·95	47·84
Whangarei	..	..	..	4·84	..	49·95
Auckland	4·29	22	0·83	4·05	36·04	38·52
Hamilton	3·49	17	1·07	4·32	31·85	37·43
Rotorua	3·48	19	1·08	4·97	36·50	31·83
Kawhia	..	..	..	4·57	..	40·75
New Plymouth	4·79	20	0·73	4·92	44·92	45·33
Riversdale, Inglewood	7·24	21	0·94	9·56	70·31	77·16
Whangamomona	..	..	..	7·11	..	56·10
Hawera	3·54	20	0·66	3·42	31·03	33·53
Tairua	3·33	13	1·02	4·92	43·87	50·63
Tauranga	3·85	18	0·78	4·29	42 29	40·41
Marachako Station, Opotiki	4·95	16	1·33	4·21	48·46	41·94
Gisborne	..	..	..	2·99	..	37·28
Taupo	3·64	16	1·16	3·82	25·23	33·12
Napier	2·65	16	0·86	1·93	19·47	24·23
Hastings	2·29	12	0·96	2·63	15·98	26·05
Taihape	3·29	21	0·70	3·04	23·88	26·56
Masterton	3·39	19	0·73	3·00	26·20	29 54
Patea	4·43	22	0·73	3·59	32·44	33·03
Wanganui	3·01	15	0·56	2·87	24·14	26·72
Foxton	2·58	17	0·61	2·40	17·90	23·73
Wellington	3·51	20	1·19	3·20	27·13	32·87
South Island.						
Westport	..	..	..	8·30	..	70·80
Greymouth	6·32	17	1·15	8·09	73·04	73·06
Hokitika	6·16	14	1·66	9·02	78·35	82·31
Ross	10·32	11	2·23	12·43	95·97	94·81
Arthur's Pass	..	..	..	15·29	..	111·36
Okuru, Westland	12·96	8	2·65	11·89	112·08	105·69
Collingwood	6·80	18	1·46	9·31	62·98	71·76
Nelson	1·12	15	0·29	3·58	25·02	28·44
Spring Creek, Blenheim	2·54	15	0·95	2·59	20·07	23·23
Seddon	3·24	10	0·90	2·14	19·84	18·76
Hanmer Springs	5·40	18	1·21	4·43	26·72	33·91
Highfield, Waiau	3·18	18	0·85	2·99	17·75	25·52
Gore Bay	..	..	..	2·94	..	24·25
Christchurch	1·83	13	0·63	1·93	18·30	18·92
Timaru	1·45	11	0·37	1·90	16·06	16·33
Lambrook Station, Fairlie	1·50	10	0·41	2·18	14·31	18·31
Benmore Station, Clearburn	0·90	10	0·29	1·93	19·47	17·95
Oamaru	1·63	14	0·47	1·64	12·88	16·08
Queenstown	..	..	..	2·54	..	21·97
Clyde	0·46	6	0·22	1·05	11·59	10·50
Dunedin	2·19	15	0·58	2·75	32·25	26·88
Wendon	1·42	12	0·40	2·42	32·53	21·69
Balclutha	1·28	12	0·30	1·89	25·79	18·16
Invercargill	2·49	18	0·50	3·24	32·79	33·02
Puysegur Point	5·06	19	1·05	6·36	66·45	61·71
Half-moon Bay	..	..	..	5·02	..	42·94

Ruakura Farm Training College,

HAMILTON.

THE Ruakura Farm of Instruction is situated in Waikato County, and adjoins the Borough of Hamilton. The farm was established as an experimental station in 1901. The training of farm students was commenced in 1912, from which time twelve students were continuously in residence. In 1920 buildings were erected to accommodate sixty returned soldiers. On the completion of the repatriation work the teaching of farm students was reorganized, and a system of resident instruction was established in August, 1923, the educational institution being termed the Ruakura Farm Training College.

COURSE OF INSTRUCTION.

The course of instruction is designed entirely for the requirements of the farmer—not of the agricultural teacher or research worker. The full curriculum occupies twelve months. The year is divided into two terms of twenty-four weeks. New students may enter the college either in January or June. The first term begins on or about 7th January, and the second term on or about 20th June.

A prospectus giving all details may be obtained from the Director of the Fields Division, Department of Agriculture, Wellington, or the Manager, Ruakura Farm of Instruction, Hamilton.

FEES.

The fee for each term for tuition and board (including soft washing) is £18. All fees are payable in advance. Students leaving before the end of their course are required to give three months' notice.

Stationery is supplied at wholesale prices.

ADMISSION OF STUDENTS.

The course of instruction is open to lads of not less than sixteen years of age and of reasonable educational attainments.

Applications for the second term (1937), commencing 5th July, should be submitted as early as possible.

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PACKING APPLES AND PEARS IN STANDARD CASES.

WM. C. HYDE, A. T. DOUGLAS, and R. E. BINFIELD.

Harvesting, packing, and storage are important links in the chain of operations in fruit-production, and very often the weakest. Common mistakes and some of the best methods in use at the present time are dealt with in the following pages.

HARVESTING THE APPLE CROP.

When to pick the Fruit.—Apples usually are best picked as soon as they reach maturity. This may be indicated by the colour of the skin or seeds, also the flavour and the readiness with which the fruit parts from the tree. It is not always so much the red colour of the skin as the shade of ground-colour; this perceptibly lightens as the fruit approaches maturity. Wide experience and careful examination are necessary to decide this important point, the neglect of which is a common and serious mistake. If left on the trees too long the skin of the fruit is liable to be disfigured by spotting, the texture of the flesh deteriorates, and juice and keeping-qualities may be lost. The harvesting of apples commences early in January, and recognized commercial varieties are ready for picking according to the purpose for which they are required in approximately the following order: Gravenstein, Scarlet Pearmain, Worcester Pearmain, Golden Pippin, Willie Sharp, Ribston Pippin, Alfriston, Cox's Orange Pippin, King David, Dunn's, Jonathan, Delicious, Lord Wolseley, Cleopatra, London Pippin, Ballarat, Rome Beauty, Grannie Smith, Statesman, Sturmer, and Dougherty, the latter reaching maturity about the end of the month of April.

Picking-equipment.—The fruit is best picked and placed in a substantial bag or bucket suspended from the shoulders in a way that it will not swing unduly, hinder the picker, or bruise the fruit. Strong orchard-boxes are required, and into these the fruit is emptied from the picking-bag. Handy tressels and ladders, no higher than necessary and as light as possible, are most suitable for picking the upper branches. The three-legged ladder commonly used is very suitable. To collect the orchard-boxes when filled, a low-wagon without sides is used to cart the fruit to the packing-shed, or on rough ground a large sledge may sometimes be used.

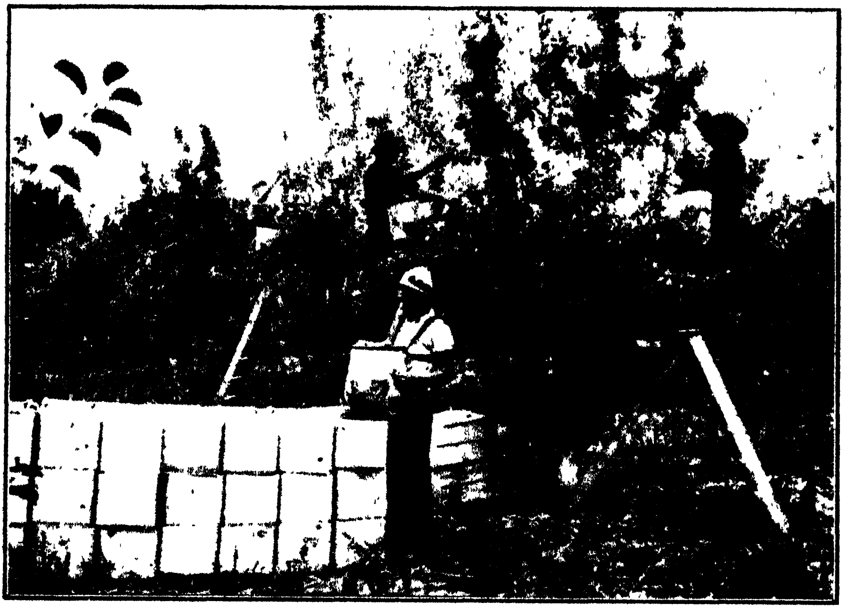

FIG. 1. HARVESTING THE APPLE CROP.

Note the tripod ladder and picking-buckets Cases should be filled only within an inch of the top to avoid bruising when stacking.

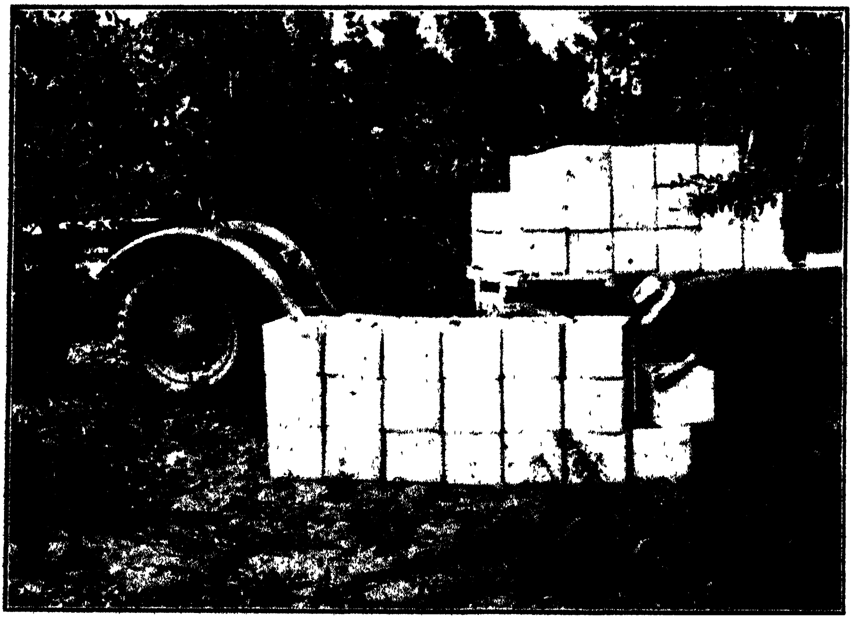

FIG. 2. A LOW-SET, WELL-SPRUNG WAGON IS MOST SUITABLE FOR CARTING APPLES FROM THE ORCHARD.

How to pick.—Inexperienced pickers should be carefully supervised until they become accustomed to the work. Apples on a tree do not all mature at the same time, and serious loss has been incurred by immature fruit being picked. The apples at the top and on the sunny side of the tree mature first; the remainder as the colour and size develops are picked. For some varieties several pickings are necessary.

The fruit should be picked with an upward movement, when, if mature, it parts readily without injury to the spur, without loss of the stem or rupture of the base of the stem, which is the cause of so much stem-rot in storage. At a picking all mature fruit should be gathered. If any is overlooked or immature fruit picked, there is a loss. Pickers should trim their finger-nails close, and handle the fruit with the greatest care to prevent injury or bruising. Orchard boxes are filled so that they may be stacked without bruising the fruit, and stood on the shady side of the tree in readiness for carting. Unsound fruit should not be placed in the boxes. There is usually very little, and it is generally best placed at the foot of the tree, where it may be collected later.

PACKING APPLES IN THE STANDARD CASE.

The Packing-shed.—As a considerable quantity of fruit will be in this building during the summer and autumn, also possibly during the winter awaiting a market, it should be placed in a cool as well as convenient position.

A concrete floor is very suitable, as it is easily kept clean, and wooden floors often give trouble when carrying heavy loads. A good light is required on the packing and grading tables, and ample ventilation in the gables or along the ridge of the roof, in addition to wide doors for the traffic of goods. The house should be built so that as little dust as possible can lie about, as cleanliness in the packing-shed enhances the keeping-qualities of fruit. The shed should be of sufficient size to accommodate an ample supply of fruit in orchard-boxes, packing-equipment, and stacks of packed fruit. The timber and box-making department is generally in an annex, or in a loft above the ground floor.

Packing-equipment.—Equipment for the packing-shed consists of a boxmaking bench, fruit-grader, nailing-press, and wiring-machine; also supplies of timber, nails, wrapping-paper, liners, pads, labels, rubber-stamps, paste, brushes, and wire. In a large establishment a section of the shed is partitioned off for an office and store-room for supplies. The arrangement of the equipment is carefully studied so as to secure the greatest economy of labour. Roller conveyers carry the packed fruit to the nailing-down press. In such an establishment a mechanical grader is used to size the fruit and convey it to bins, in each of which fruit of one size is piled ready for the packer. Mechanical graders of different styles and capacity may be obtained for this purpose. For driving the mechanical grader an electric motor is preferred. An oil-driven motor is a good substitute, but it should be placed outside the packing-shed under cover. Artificial lighting is a great convenience, as it enables packing to be done at night during rush periods. The grading-table, packing-bins, and nailing-press should receive special attention in this respect.

In many small establishments the fruit is graded and sized by hand, either direct from the orchard-boxes or from a hessian-covered table on which the fruit has been tipped. A row of bins for fruit of different sizes will then be required. Useful equipment of this kind can very well be made by the orchardist.

The standard apple-box, having an inside measurement of 10½ in. by 11½ in. by 18 in., is made up from cut timber supplied in bundle form with definite counts of end, side, top, and bottom pieces, and cleats, the dimensions of which are as follows :—

Ends : Two pieces, each planed on one side, ¾ in. by 11½ in. by 10½ in.
Sides : Two pieces, 5/16 in. by 19½ in. by 10½ in.
Tops and bottoms : Four pieces, 3/16 in. by 19½ in. by 5½ in.
Cleats : Four pieces, 5/16 in. by 11½ in. by ¾ in.

Cases made of two-piece sides and two-piece ends are sometimes used, provided the side boards are of equal width and are cut or planed to an equal thickness. The grain of the end boards is parallel with its greatest measurement and the two pieces are securely joined by means of corrugated fasteners, one close to each edge on the one side and one midway between on the reverse side.

The local timber recommended for the construction of export cases is white-pine of good quality, but *Pinus insignis*, rimu, or beech timber is acceptable if properly cut and used with flexible tops and bottoms not exceeding 3/16 in. in thickness.

The nails used are at least 1½ in. long, 14 gauge.

All fruit exported, and much of that which is placed on the local market, is wrapped individually in paper glazed on one side

The following sizes are most suitable :—

For apples 96 and larger to case use 11 in. by 11 in. paper or double wrap with 10 in. by 10 in.
For apples 100–138 to case use 10 in. by 10 in.
For apples 150–180 to case use 10 in. by 10 in. or 9 in. by 9 in.
For apples 198–234 to case use 9 in. by 9 in.
For apples 252–270 to case use 8 in. by 8 in.

Organization of the Staff.—A large packing-shed during the harvest is a very busy place, and good administration is necessary to get the work done quickly and well. If the planting has been done wisely, the harvest will be conveniently spread to enable large quantities of fruit to be handled with a moderate sized staff.

It is important to see that pickers, graders, packers, boxmakers, and the man nailing down thoroughly understand their duties as they are very exacting. The supply of fruit from the orchard and casemaking should be regulated to the requirement of graders and packers, to avoid congestion and double handling or loss of time. Help will also be required to supply fruit to the graders, empty boxes to packers, and remove low-grade fruit. Good management will secure a happy, capable crew that will do good work without waste. The man nailing down and wiring cases should be very capable and familiar with all regulation requirements. He should return all packed boxes not up to standard, as he is the last man to see the pack he should be finally responsible.

FIG. 3 TO MAKE GOOD BOXES QUICKLY A SUBSTANTIAL BENCH, PROPERLY EQUIPPED, IS REQUIRED

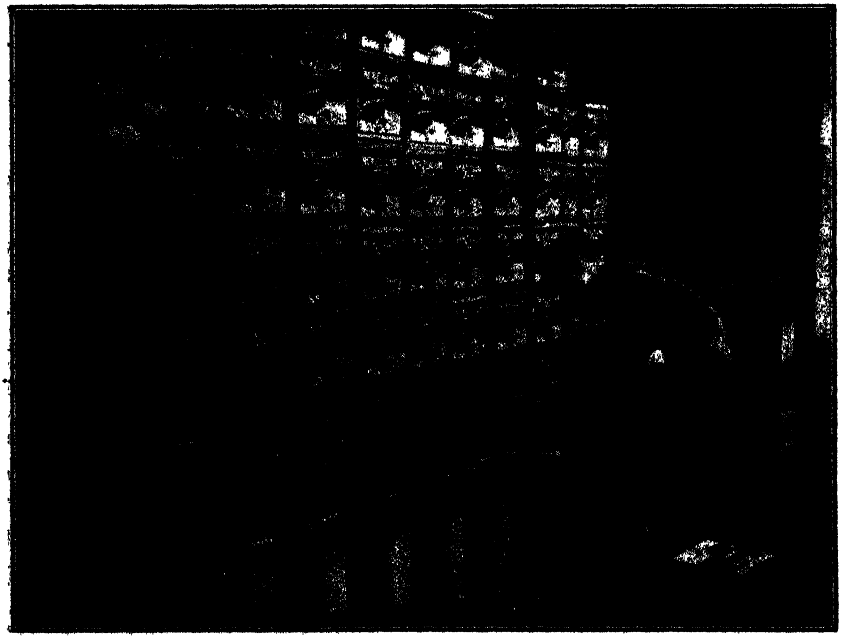

FIG. 4. LABELS MUST BE CLEAN AND LIGHT. LINE UP THE BOXES, APPLY A GOOD PASTE, THEN THE LABELS, AND FINISH WITH A CLEAN BRUSH.

Making and labelling Boxes.—To give a box good appearance and sufficient strength, boxmaking and labelling are carefully specified, and this should be carried out with equal care. The end pieces of a box are placed in a steel or wooden frame on the bench, planed side outermost, one side is nailed on; it is then turned and the other side board is fastened in position, after which the bottom pieces and cleats are laid in position and securely nailed. The corners should be square and flush, and the nails, spaced not more than 3 in. apart, should be driven flush and not sunk; the outer nails being not more than 1 in. from the edge of the board. Nails with point projecting when driven must be withdrawn. All cases should be clean, dry, and sound, and well up to measurement.

As the contents and consignment-marks are usually placed on the label, the necessity of good labelling is obvious, for when they become torn or lost altogether, as sometimes happens, serious difficulties arise. There are many right ways and wrong ways of labelling; one of the former is as follows:—

Place the box-ends planed side uppermost before making up in a row on a bench, or slide long enough to hold twenty-five or fifty of them. Apply the paste to the boards with a wide brush, and then take the labels and place them carefully in position. With a clean brush each label is then pressed firmly to the wood with a motion from the centre outwards to avoid air bubbles, and the labelled ends are stacked to dry before making them up. Any convenient method is satisfactory so long as a clean, fresh, reliable paste is used and the label is properly placed and firmly affixed over the whole of its area. Labels should as far as possible be overprinted with essential particulars, leaving only the count—that is, the number of apples per case—to be applied with a rubber stamp.

For the export trade a label of approved design is placed on each end of every case, words and figures indicating the following only are permissible on the label: (1) "New Zealand Apples"—"New Zealand" to be composed of 1¼ in. letters and the word "Apples" ¾ in. in height; (2) grower's registered number to be of 1¼ in. type; (3) consignee's registered number or shipping-mark to be of figures not less than 2½ in. and not more than 3 in. in height; (4) name of variety of apple, grade, and number of apples in the case—all of which must be of ½ in. type. The grade is printed on each label. The name of the variety must be placed immediately above, and the number—indicating the apples in the case—on the right of, and in line with, the grade name. These particulars are usually overprinted on the label, with the exception of the count, which is applied with rubber stamps at the nailing-press.

Grading and Sizing the Fruit.—The fruit in orchard boxes are received at the packing-shed and stacked to a convenient height from five to six cases high, according to the space available adjacent to the grading-table. Fruit may be stacked on both sides of the grader if space will permit, as this enables the person in charge of the grading to deal with the fruit according to the length of time

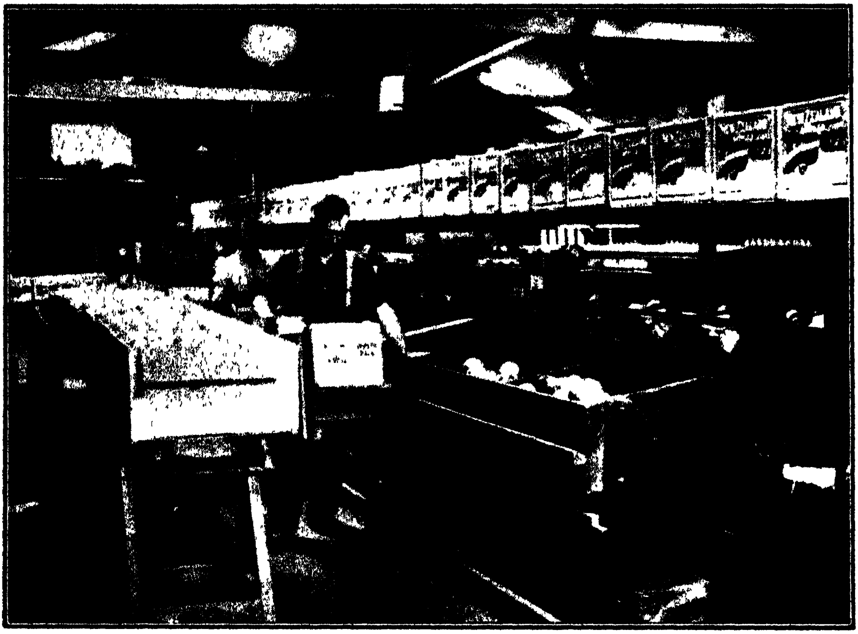

FIG. 5. INTERIOR OF PACKING-SHED DURING THE HARVEST.

Over the grading-machine are the empty boxes. As they are packed the packers' tally-card is inserted and the box is placed on the conveyer and passed to the lidding press.

FIG. 6. EQUIPMENT SUITED TO ANY REQUIREMENT IS NOW AVAILABLE.

it has been picked. To prevent heating and to allow the air to circulate through the stack, the cases should stand a few inches clear of the walls and an inch or so between the perpendicular tiers. It should remain there at least twenty-four hours to permit a certain amount of evaporation, which will minimize wet brushes and blemish marks in packing and handling. This is specially important if recent rains have been experienced.

The fruit is graded and sized by carefully tipping it on a grading-table, where defective fruit is removed, placed in boxes, and stacked by itself. The remainder is passed over a sizing-machine and comes to rest in bins, in each of which the fruit is all of one size and grade ready for the packer. Most machines of this kind of any capacity do good work, but it is essential that they be kept thoroughly clean and adjustments carefully watched. Apart from this mechanical supervision, less skill and experience are required by the operators as compared with grading and sizing by hand. The latter method, however, is suitable for small packing-sheds, and experienced operators will instantly decide the grade and size of fruit when they handle it. Such graders sort into a row of bins from one side, while the packers pack out of the bins on the other side. The bins have padded bottoms, which are slightly inclined towards the packers, and have an opening, an inch or so wide, between the lower edge and side of the bin to allow dust and litter of any kind to be readily removed by brushing. The graders may work from orchard-boxes or from a narrow table about 2 ft. wide covered with hessian on which the fruit is tipped.

A common fault which tends to injure fruit while grading is the overloading of the grading-table, conveyer-rollers, and belts, resulting in crowding apples in restricted spaces, causing stem punctures, scratches, and abrasions. Sufficient fruit only to keep the packers employed should be allowed in the bins. Overloading the packing-bins is a common source of injury to fruit.

Standard grades for apples and sizes packed are subject to slight alteration each season—those set for the 1937 export season are as follows:—

"Extra Fancy," "Fancy," and "Good" Grades.—Apples of these grades shall be mature, sound, smooth, clean, well formed, carefully hand-picked from the tree, properly wrapped, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer. Individual apples of either grade shall carry not less than the percentage of colour, and not more than the percentage of blemish and unnatural russet indicated in the appended general list with respect to each variety in the respective grades.

Insignificant, healed-over insect stings or bites in export fruit shall be limited as follows: "Extra Fancy," not exceeding 5 per cent., with no more than one sting or bite on individual fruits; "Fancy" and "Good" grade, not exceeding 10 per cent., with no more than two stings or bites on individual fruits.

XF = Extra Fancy; F = Fancy; G = Good; HCC = High characteristic colour; GCC = Good characteristic colour.

Varieties.	Sizes.				Sizes		Colour.			Blemish.			Russet.		
	United Kingdom.		Continent of Europe.		Other Markets										
	Max.	Min.	Max.	Min.	Max.	Min	XF. %	F. %	G, %	XF, %	F, %	G, %	XF, %	F, %	G, %
Solid Red.															
1. Rokewood	125	252	125	198	125	252	60	25	10	3	3	5	5	10	20
2. Tasma	125	216	125	198	125	216	70	30	10	3	3	5	5	10	20
Partial Red.															
3. Brighton	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
4. Delicious	125	216	125	198	125	216	45	15	5	3	3	5	5	15	30
5. Dougherty ..	125	252	125	198	125	252	45	15	5	3	3	5	5	10	20
6. Frimley Beauty ..	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
7 Glengyle Red ..	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
8 Jonathan ..	125	234	125	198	125	234	45	15	5	3	3	5	5	15	25
9 Scarlet Nonpareil ..	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
10. Stark	125	234	125	198	125	234	45	15	5	3	3	5	5	10	20
11. Worcester Pearmain	138	234	..	..	138	234	45	15	5	3	3	5	5	10	20
12 Yates	138	252	138	198	138	252	45	15	5	3	3	5	5	10	20
Striped															
13. Cox's Orange Pippin	150	270	..	..	150	270	20	5	*	3	3	5	5	30	50
14. Gravenstein ..	138	234	..	..	138	234	†	†	†	3	3	†	5	10	†
15. Kidd's Orange Red	138	234	138	198	138	234	25	10	*	3	3	5	5	10	20
16 Rome Beauty ..	125	234	125	198	125	234	25	10	*	3	3	5	5	10	20
17 Statesman ..	125	234	125	198	125	234	20	5	*	3	3	5	5	10	20
Yellow or Green.															
18 Alfriston	88	198	88	198	88	198	HCC	GCC	..	3	3	..	2	12½	No good grade allowed
19 Ballarat	88	198	88	198	88	198	HCC	GCC	..	3	3	..	2	12½	
20. Cleopatra ..	125	234	125	198	125	234	HCC	GCC	..	3	3	..	2	12½	
21 Dunn's	96	216	96	198	96	216	HCC	GCC	..	3	3	..	2	12½	
22. Golden Delicious ..	125	216	125	198	125	216	HCC	GCC	..	3	3	..	2	12½	
23. Grannie Smith ..	113	234	113	198	113	234	HCC	GCC	..	3	3	..	2	12½	
24. London Pippin ..	125	216	125	198	125	216	HCC	GCC	..	3	3	..	2	12½	
25. Lord Wolseley ..	113	216	113	198	113	216	HCC	GCC	..	3	3	..	2	12½	
26. Newtown Pippin ..	125	234	125	198	125	234	HCC	GCC	..	3	3	..	2	12½	
27. Parlin's Beauty ..	96	216	96	198	96	216	HCC	GCC	..	3	3	..	2	12½	
28 Pioneer	138	234	138	198	138	234	HCC	GCC	..	3	3	..	2	12½	
29. Sturmer Pippin ..	125	234	125	198	125	234	HCC	GCC	..	3	3	..	15	75	
30. Willie Sharp ..	125	234	..	..	125	234	HCC	GCC	..	3	3	..	2	12½	

* Colour showing. † Colour requirements of Gravenstein: Extra fancy—pronounced stripe; Fancy—clean bright fruit. Good grade of this variety will not be accepted for export.

(To be continued.)

On a light-land farm in Canterbury two adjacent paddocks, which had originally been sown down with the same mixture, provide a striking example of what subterranean clover can do for a pasture. One of these paddocks was surface-sown with subterranean clover two years ago and now carries a good cover of rye-grass, while the pasture in the other paddock has entirely run out, being practically all hair-grass.

LIVER-FLUKE IN NEW ZEALAND SHEEP.

W. V. MACFARLANE, Zoologist, Veterinary Laboratory, Wallaceville.

SPORADIC outbreaks of black disease in sheep have occurred since the first investigation of the trouble in the years 1924 to 1928 in spite of the efforts that have been made to control the factors causing mortality. It was shown at that time that the larval liver-fluke (*Fasciola hepatica*) entered the liver and burrowed through the tissues to stimulate the growth of the bacillus *Clostridium oedematiens*. The toxin derived from the bacillus caused the death of the infected animal. During the first half of 1937 the death of at least five hundred sheep, chiefly breeding-ewes, from black disease has come to the notice of the Department in Hawke's Bay. In addition to this loss there is still a large number of rejections of livers at the meat-works because of the presence of fluke, and the liver-fluke is, after hydatids, the most serious cause of condemnation of livers at the works in the fluke area. Direct loss of sheep, however, or wasting of their condition from the presence of large numbers of adult fluke in the bile-ducts is now negligible as a result of the regular drenching with carbon tetrachloride which has been undertaken in Hawke's Bay.

The mammalian hosts of the liver-fluke are sheep, cattle, goats, rabbits, and, occasionally, man. It was formerly considered that the intermediate host of the parasite was the small black mollusc *Potamopyrgus*. Large populations of *Potamopyrgus* spp. are common in streams and lakes throughout the country. This genus is sharp-spired, there are six tight whorls to the shell, and the opening of the shell is able to be closed by an operculum (Fig. 1 (v)). This is not the host of the liver-fluke, however, though it harbours the immature forms of at least fourteen other flukes whose adults live in fish, birds, or mammals. An examination of 5,200 specimens of this genus did not reveal one infection with fluke ; and that observation was supported by the fact that the miracidium hatched from fluke eggs would not penetrate the tissues of *Potamopyrgus antipodum* or *P. corolla*.

In Hawke's Bay and Poverty Bay the only intermediate host of the fluke that was discovered in the recent reinvestigation was *Myxas ampulla* (Fig. 1 (iii), (iv)). This snail grows to the length of one centimeter. It is a broad-shelled animal of a grey or green-brown colour. There are four whorls to the shell ; the first three apical whorls are small and the fourth is large and ovoid to shelter the greater part of the animal. The fleshy foot protudes slightly from the opening of the large whorl, and there is no operculum to the shell. Examination was made of 2,300 specimens of this snail, and fluke infection was found to vary in different localities from complete absence to 43 per cent. In a normal fluke-infested pasture there are usually about 5 per cent. of the *Myxas* carrying parasites. The identity of the parasite was established by feeding the cysts to laboratory-bred rabbits, from which mature fluke were recovered after fifty days.

Occasionally species of *Isidora* (Fig. 1 (i), (ii)) may be found in lagoons, but they may be readily distinguished from the fluke snail by the fact that the whorls twist to the left. In *Myxas* the whorls twist to the right.

HABITATS OF MYXAS AMPULLA.

The habitats of *Myxas* are well defined and limited. The snail is an air-breathing animal adapted for life on muddy areas Accordingly it is not found in deep or fast-running waters with clearly cut banks. The characteristic locality in which *Myxas* lives is a seepage from the hillside where the flow of water is imperceptibly slow but is constant throughout the year Stagnant water is quite unsuitable: it is well-aerated water that is required. A short green rush (*Juncus lampocarpus* (Fig. 2)) grows in such seepages, and when it is growing sparsely with extensive patches of bare mud in the association it provides the best habitat (Fig. 3). Only fine silty loams form a suitable substratum for *Myxas*, which may be found either moving over the soft mud or mating in the water-filled hoofmarks of the swamp.

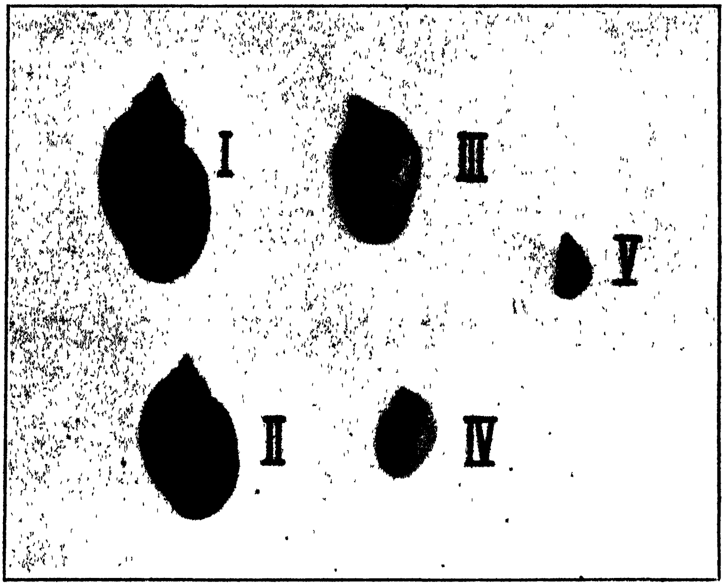

FIG. 1

I and II *Isidora* spp These molluscs are rare, and are not infected with fluke III · Full-grown *Myxas ampulla*, 1 cm long. This snail is the only known host of liver-fluke in New Zealand IV Half-grown *Myxas ampulla* V. *Polamopyrgus antipodum*. The common and widespread stream snail that has been shown *not* to be on intermediate host of the fluke

Where the *J. lampocarpus* grows very densely or where large growths of moss and algæ have taken place, *Myxas* will seldom be found.

Besides on the swamp ground formed from springs, fluke-snail habitats develop on flats in the course of streams where depositions of silt have been overgrown by short green rushes. Some good cultures of *Myxas* are also found on open stretches of soft mud where *J. lampocarpus* does not grow. An example of this occurs on the bed of the former Inner Harbour at Napier.

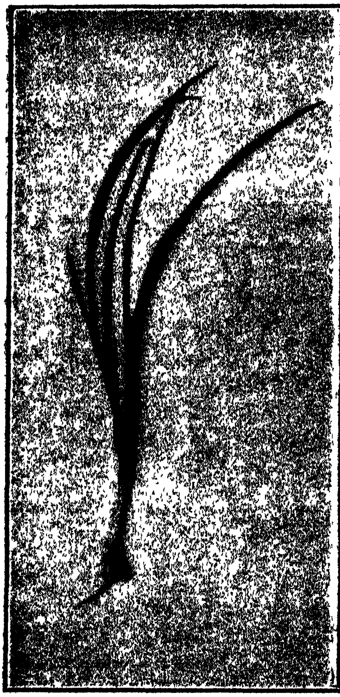

FIG. 2.

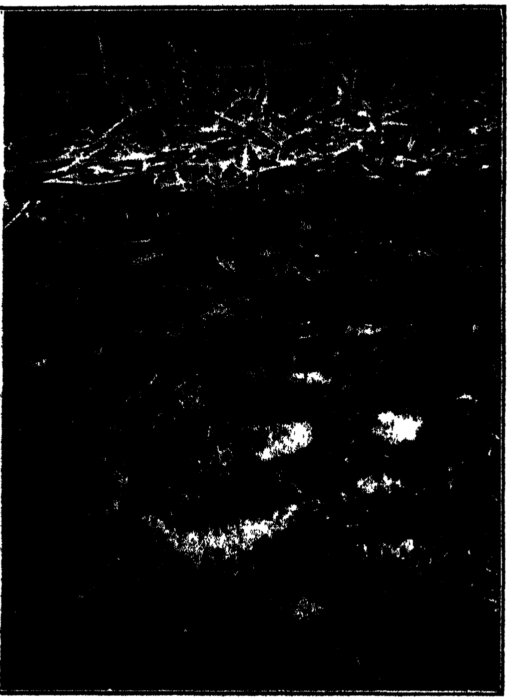

FIG. 3.

Fig. 2.—A single plant of *Juncus lampocarpus*, the short rush that grows on the fine mud of the swamps inhabited by *Myxas*.

Fig. 3.—A typical fluke-infested area formed from a hillside seepage. Water is seen lying in depressions trampled by stock with a growth of *Juncus* around each depression. The silt of this swamp is formed from sandstone, limestone, and Taupo pumice, and is grey-brown in colour.

Patches of watercress, drains in which the water flows fairly rapidly, and stagnant brown waters are unimportant in the spreading of the fluke. Sluggish drains that have become overgrown with cress or rushes accommodate small numbers of *Myxas*.

Stock are infected, therefore, by eating the rushes or drinking from depressions in the swamp where fluke cercariæ are encysted.

DISTRIBUTION.

The liver-fluke has been reported from areas near Nelson, Opotiki, and Ngaruawahia, and its incidence has been studied in Hawke's Bay and Poverty Bay. Fluke swamps are formed on grey, brown, and dull-yellow soils. The derivation of these soils is limestone (grey), limestone, sandstone, and pumice (grey-brown), sandstone (dull yellow), and mudstone (grey). On the east coast of the North Island limestone and sandstone fluke habitats are found from Dannevirke to Tutira. From Tutira northwards the coastal soils are basically either sandstone or mudstone, with a short outcrop of limestone from Nuhaka to Tiniroto.

Very few snails and no fluke have been found on the red soils formed from the volcanic ash showers (from Tongariro) which do not extend farther east than Kereru, Puketitiri, and Te Pohue. The Taupo rhyolitic pumice does not disturb the incidence of *Myxas*. Peat and peaty loam is inimical to *Myxas*. South of Dannevirke, and in the greywacke foothills of the ranges (Ruahines, Raukumaras, Kawekas), the snail has not been seen. In those areas the soils are either derived from greywacke or are dun-coloured bush soils, neither of which provides a favourable substratum, though *Juncus* swamps are common.

Thus fluke is present on limestone and sandstone, but it is absent from peat, andesitic volcanic ash, and bush soils.

BIOLOGY OF MYXAS AND THE FLUKE.

Pastures are infected with fluke-eggs continuously throughout the year. It has been shown that an individual fluke may survive in the liver for three years, though one year is a more usual length of life. During adult life the fluke does not cease to produce eggs. In Hawke's Bay during the summer and autumn the eggs hatch in two or three weeks according to temperature. In April, however, the time of hatching lengthens, till in May there is practically no development of the embryo. A mean monthly temperature of 50° F. is necessary for appreciable hatching, and the rate of development is directly determined by the mean temperature. Hatching is negligible from May to October in Hawke's Bay.

During the winter *Myxas ampulla* breeds slowly and a considerable mortality of the larger snails takes place. By October the first spring generation of snails is ready for infection with the newly hatched fluke-larvæ. The immature fluke develop during seven weeks in the snail and digest their way out at the end of that period to encyst on the mud or on the stems of *Juncus lampocarpus*.

It would appear that the most suitable time to kill the host snail is before the liberation of young fluke from November onward and after the winter flood waters have receded. It is not advisable to poison the snails when the swamps are at their maximum size since bluestone would be wasted on areas that would not support snails during a dryer period. Any dry spell during August, September, or October would therefore be a suitable time for bluestoning, and similarly in April the swamps are usually well defined and the killing of the intermediate host may be more easily carried out. The use of copper sulphate, however, appears not to be so valuable as it was formerly considered to be. This is due to the facts that the snail requires a considerable concentration to kill it, that much of the copper in limestone country is precipitated as an insoluble carbonate, and that the eggs and many of the snails living amongst the vegetation never come into contact with the poison. Swamps that have been bluestoned heavily during several years have been found still to carry an infection of *Myxas*. Bluestone is of value in controlling *Myxas* living in choked drains, but it is in no way to be considered as a substitute for draining.

The eggs of the fluke and of the snail are almost unharmed by copper sulphate, so that the effectiveness of the poison is restricted to newly hatched and adult snails. Bluestone is most satisfactorily used by scattering the powder at the rate of 20 lb. to 40 lb. per acre over mud and water-filled hoof-marks in the *Myxas* habitats. There is considerable wastage and small effect from placing bluestone in bags in the course of streams, since, even if there is a swampy area at the side of or in the course of a stream, it is often not directly in the flow of stream water. The bluestone must go on the mud. Copper sulphate has, of course, no ill effects on stock in the concentrations available.

Myxas is killed by complete drying for one day, but is able to survive on or in damp mud for several weeks. Its eggs, too, persist on damp mud. In view of the relative inefficiency of copper sulphate in controlling the snail population, draining of swampy areas seems by far the best method of eradicating the liver-fluke. If a drain is dug 2 ft. deep and 2 ft. wide at the top it reduces the amount of water on the mud where *Myxas* lives and within a year has made the locality unsuitable to the snail. Complete drying out is not necessary, and as soon as prolific growth of moss, or an invasion of white clover takes place the drains' function is practically fulfilled. They must, however, be kept as clean as possible with a fast flow of water for at least three years.

The major liberation of flukes from the host snail takes place in late spring and summer. Lambs are found to be infested with mature fluke by the end of January, so that the encysted cercariæ are available on the pasture in numbers by the beginning of December. In suitably moist and cool conditions the cysts are known to survive from one season until the next, but the number of these survivors will be small compared with the number of newly-formed cysts. The survival of infective flukes accounts for cases of black disease outside the usual February to June season. When the fluke cyst has been taken in by the sheep the young fluke burrows through the wall of the intestine and in from five to fourteen days penetrates the liver. As the fluke digests its way through the tissues of the liver a condition is set up in which the spores of the black disease bacillus germinate and commence vegetative growth. The bacterial toxin produced kills the sheep. There is no cure, but prevention of the growth of the bacillus by vaccination before February is possible. In addition, the burning of carcasses and eradication of *Myxas* should be undertaken to prevent a recurrence of the disease.

Within fifty days of the time cysts are ingested the bile-ducts of the liver may contain egg-laying fluke. Thus the young parasite spends at least six weeks in the liver-tissues before migrating to the bile-ducts. In the mature stage (only) fluke may be removed from sheep by drenching with 1 c.c. of carbon tetrachloride. Any time of the year is suitable for drenching, but it must be remembered that one dose will remove only the adults. So the bile-ducts will receive parasites constantly from the liver-tissues for two months after the first dose even if there is no further infection. This makes further drenchings necessary

The most useful time, however, at which to administer carbon tetrachloride is late autumn Drenching in April and June will remove the major infection acquired in summer and autumn This procedure will prevent the fluke from infesting the pasture with its eggs throughout the winter and relieve the sheep of the parasite burden which might be dangerous during a bad season. Spring and summer 'drenching should not be neglected in the more seriously infected areas.

Winter	Spring	Summer	Autumn
Few *Myxas.* Few *Myxas eggs.* No fluke-eggs hatch	Fluke-eggs hatch Infection of snails with fluke *Myxas* breeding	Liberation of fluke from snails Larval fluke in livers of stock	Cysts available on pastures Adult fluke in liver.
Drenching Draining	Bluestoning of swamps	Vaccination of ewes against black disease Drenching	Bluestoning Drenching

The above scheme illustrates the periodicity of the fluke and its host and relates that periodicity to the measures necessary for the eradication of the parasite.

To Dr. C. S. M. Hopkirk, who instigated this work, I am grateful for assistance in experimental infections and for many facilities. Regional officers of the Department of Agriculture lent valuable assistance, and the hospitality of station-owners on the east coast was both useful and greatly appreciated.

DAMAGE BY SLUGS.

J. MUGGERIDGE, Government Entomologist.

IN connection with the garden slug *Agriolimax agrestis*, the following information culled from the literature should be of assistance :—

The slugs belong to the same division of the animal kingdom as snails, clams, and oysters. They are typically nocturnal in habit, and by far the greater portion of the damage caused by them is carried on at night, in dark, moist, cloudy weather ; however, they remain active throughout the day.

The food habits of the above species are surprisingly variable ; it is almost an omnivorous feeder with a preference for a vegetable diet. Feeding takes place below, at the surface, or above the surface of the soil. Among vegetables Cruciferae seem the favourite host, lettuce, cabbage, and cauliflower particularly, and radishes and turnips to nearly the same extent. Peas, beans, tomatoes, potatoes, and beets are seriously attacked. Among field crops probably peas and beans are more generally injured, though rape, clover, wheat, oats, and many other crops suffer.

Data concerning life-history studies is meagre. The eggs occur at all seasons of the year, but are more common in the spring and early summer. They are placed under stones, boards, and rubbish, under accumulations of grass and weeds, about fence rows and in other moist, shady places. Where natural protection is not available the slugs burrow out a small shallow pit in the surface of the soil with smooth rounded sides and a surface opening. The eggs are laid in clusters of from two or three to fifty or sixty and more. The period from egg to maturity will vary with the season and abundance of food, but is probably from ninety days to nearly a whole year. No data is available concerning average longevity of the slug, though one writer states that the average span is probably from eighteen months to two years.

CONTROL FOR SLUGS.

(*a*) *Climatic.*

Adverse climatic conditions, such as dry, hot weather, drives the slugs into seclusion and tends to minimize injury. Under conditions where plant foliage is luxuriant, however, slugs may find conditions suitable for their depredations—for example, during summer months it is common to find slugs in leafy cabbages or cauliflowers, &c. Excessive rain drives slugs from their seclusion, and frequently they will drown in small pools of water. During cold weather they are likely to remain dormant, but probably cold does not kill them.

(*b*) *Natural Enemies.*

Poultry, particularly ducks and geese, seem especially fond of slugs. Several birds, such as the thrush and blackbird, occasionally feed on them. They are attacked by some species of insects, but comparatively little has been done on this aspect of the problem.

(*c*) *Clean Surroundings.*

Owing to the habits of the slug in seeking shelter among debris, in long grass, under boards, &c., it will be clear that, following a thorough cleaning-up of all such places, a considerable reduction of the slug population should result. Remove and burn all trash and rubbish when possible. Autumn ploughing should be adopted where practicable and the ground kept clean from weeds.

(*d*) *Applied Control.*

The use of quicklime is, of course, an old remedy and quite effective under some conditions. A more recent remedy which has been recommended by some writer consists of dehydrated copper sulphate (bluestone) plus hydrated lime in the proportions of one part of the former to ten parts of the latter. This mixture must be kept in closed cans to avoid dampness. No experimental work has been conducted in New Zealand to determine the relative value of this compound as compared with other "slugicides," but the writer has found it useful in checking an outbreak of slugs found to be infesting field cabbages. The mixture should be applied with a dusting-machine at the rate of 30 lb. to 50 lb. per acre. The best time to apply it is on a warm evening after a drizzling rain or, perhaps better still, in the early morning following moist conditions and at a time approximately when the day is breaking. The effect of the dust on the slugs is to cause profuse salivation and death within a few minutes

THE AGRICULTURAL YEAR.

ITEMS FROM THE DEPARTMENT'S ANNUAL REPORT.

THE annual report of the Department of Agriculture was presented to both Houses of the General Assembly recently. It provides a summary of the principal farming activities of the year, and outlines the comprehensive and numerous activities of the Department in its work of maintaining and fostering the growth of the rural industries. The following items of an instructional and informative nature to farmers have been culled from the reports of the Directors of the various Divisions of the Department :—

JOHNE'S DISEASE.

The evidence accumulated throughout the year shows that this chronic disease of cattle is being reported on several fresh farms from time to time. In the Waikato the disease was confirmed on seven fresh farms during the year, and in Taranaki the disease was shown to exist on ten further farms. Although on many of these farms the actual number of cattle affected with the disease is small, the increase in the number of farms affected, together with the difficulty of knowing the exact extent of the disease in any one district, makes the problem of control of the disease a serious matter. The chronic nature of the disease, with the long period of incubation before clinical symptoms are shown, is a feature of the disease which handicaps the most enthusiastic worker in any survey as to the exact incidence in any district.

In the control of the disease the Johnin test is being availed of by veterinarians in the Taranaki and Waikato districts. In the Waikato district this work is being carried out by Mr. Marshall, assisted by Mr. McDonald. In the Taranaki district Mr. Stephens, Stratford, carried out the intradermal Johnin-testing. The South Taranaki district work in connection with Johnin-testing is now being carried out by Mr. Alexander, Hawera. The slow and exacting nature of this work being carried out and recorded reflects credit on the officers concerned.

A semi-annual Johnin test is being applied to a number of herds, and reactors are being slaughtered. It is hoped in this way to eventually eradicate the disease from such herds. The draining or fencing of swampy areas and subsequent heavy dressing with lime are measures adopted with a view to eradication of the infection from contaminated farms. A series of semi-annual tests must be applied, and some time must elapse before any definite statement can be made.

In order to prevent the spread of the disease it is now necessary to have all dairy cattle intended for shipment to the South Island tested by the double intradermal Johnin test prior to shipment. Although a limited amount of testing in this connection has been done, it is gratifying to know that so far no reactors have been found. This is evidence that the disease is confined to definite areas.

* * * * *

MAMMITIS.

The position in regard to mammitis during the year would appear to be less satisfactory. The larger number of cases in many districts can be attributed to the very variable season with the higher rainfall in the spring and throughout the summer. Under such seasonal conditions the sanitation measures necessary in and about many milking-sheds cannot be maintained, and an increasing number of cows show mammitis as a consequence. In wet seasons there is an increase in the number of cows affected with pox on the udder and general abrasion of the teats, resulting in more cases of mammitis. A high standard of hygiene in the shed is difficult to attain in such a season.

The facilities provided by the Wallaceville and Hamilton laboratories in the examination of milk-samples for farmers are still being availed of and are much appreciated by owners desirous of a means of control. The mammitis-control scheme of the laboratory should be taken more advantage of by farmers as the value of hygienic measures in prevention cannot be given too much importance.

* * * * *

CONTAGIOUS ABORTION.

This disease of cattle is in the same position as in former years. It would appear that a reduction in the number of outbreaks as compared with the previous season is to be recorded. The control of the disease must be based on hygienic measures adopted in the management of the dairy herd, the isolation of affected animals, and the furtherance of the principle of self-maintenance in regard to replacements in dairy herds.

The testing of blood-samples by the application of the agglutination test is of considerable importance to the owner of the herd and also to the officer who is investigating the disease on affected farms. The control measures to be adopted depend largely upon the result of the blood test showing the extent of the disease in any herd.

* * * * *

TEMPORARY STERILITY.

This trouble has been on a level with previous years. The investigations in regard to the several aspects of the ætiology of the condition of delayed conception in dairy herds are being continued. There is no doubt that delayed conception, as a breeding problem for the farmer, is not due to any specific cause, the female factor, the male factor, the disease factor, and the nutritional aspect all requiring to be further investigated. After investigation of the history of the trouble on many farms at the present time suitable remedial measures can be suggested.

* * * * *

ERGOTISM AND "FESCUE POISONING."

In districts where tall fescue is liable to become a rank growth and allowed to form seed heads there is always the danger of animals being affected with ergotism when the farmers use such growth for stock during the winter months of scarcity. There is not the same danger when the fescue growth has been controlled by suitable grazing throughout the season.

* * * * *

PARASITIC DISEASE IN YOUNG CATTLE.

Parasitic gastro-enteritis and bronchitis still continue to be a problem for the producer who raises young stock. Many calves on dairy-farms are lost annually from this disease, and many more are of weak constitution following a severe attack of worms. In many cases weaning takes place too soon or supplementary feed is not supplied to make up for the deterioration in the feeding-value of pasture during the autumn and winter. Better-developed calves with stronger constitutions would result from a more prolonged feeding with milk or other reasonable substitute, and in the rearing of good calves better feeding is the basis of success. The production of stronger, better-constitutioned yearlings would improve the disease position generally in many herds in the course of a few years.

PARASITIC DISEASE IN SHEEP.

The control of parasitic disease in sheep during the past season has again proved to be very necessary if heavy losses are to be avoided. The unseasonable feed conditions for sheep throughout have made it difficult to carry over hoggets with any degree of immunity from loss. Hogget feeding and wintering is a more or less specialized branch of sheep-farming and unless farmers give special thought and attention to it the results are at times very discouraging. The provision of supplementary feeding in the way of hay, roots, ensilage (and in some cases oats and peas are available) reduces the risk of loss to a very marked extent. It is necessary also to provide a balanced ration wherever possible, as too much watery feed such as roots alone prove of doubtful value. Too much emphasis is often placed on the use of drenches of worm preparations without due attention to the feed conditions. In other cases, although the feed conditions are reasonable, drenching is totally neglected or left until the hoggets become weak and scouring takes place. The instructions given by field officers to drench early and repeat at intervals with a reliable drench such as the copper sulphate-nicotine mixture, and attention to the feed conditions are most satisfactory, and where carried out give very satisfactory results. It is pleasing to record that this drench is being quite generally used in the eradication of worms from infested stock.

PULPY KIDNEY.

Reports indicate that in the Otago district the losses from this disease were generally below the average of the last two years. In a few instances, however, lambs of an older age were affected with the disease, and this also applied to some losses recorded in the Nelson district.

An extension of the vaccination of the pregnant ewe with a view to conferring immunity on the lambs through the colostrum was organized and carried out by Mr. Dayus, District Superintendent, Dunedin. Mr. Dayus reports: " In all, 2,608 ewes were vaccinated with a vaccine prepared at the Wallaceville Veterinary Laboratory. In addition, observations were maintained on a group of 1,141 ewes, which were vaccinated by farmers, in some cases without help, with a commercial entero-toxæmia vaccine purchased from the Commonwealth Serum Laboratories, Royal Park, Victoria. In all cases a suitable number of control ewes were reserved, which, with the vaccinated ewes, were depastured together. The results briefly show that in the group of 2,608 vaccinated ewes the losses of lambs from pulpy-kidney disease were eight, whereas in the control group of 2,500 unvaccinated ewes the losses totalled eighty-four, or in other words the losses of lambs from vaccinated ewes were 0·306 per cent., whereas the loss of lambs from the control unvaccinated ewes was 3·36 per cent. In the second trial, using the commercial vaccine, the losses of lambs from 1,141 vaccinated ewes were 22, or 1·92 per cent., whereas the losses of lambs from 2,275 control ewes were 84, or 3·68 per cent."

* * * * *

Lymphadenitis.

Although the incidence of this disease in sheep is not so high in New Zealand as in some other countries, it is, nevertheless, a disease which, from a carcass and meat inspection point of view, requires to be kept in check to enable the export of these products to be carried out without any undue restrictions. It has been clearly demonstrated that the regular annual palpation of live sheep will detect affected animals and a continuance of this practice on infected properties over a few years leads to a marked reduction of the disease in infected flocks. Furthermore, the precautions, previously outlined, at shearing-time should be more seriously adopted by farmers in order to reduce the incidence of the disease in the carcass to a minimum. The chronic nature of the disease which allows it to remain undetected in many cases until the carcass is examined for export may account for a lack of interest. Affected carcasses are rejected for export.

* * * * *

Lice and Ticks.

The previously recorded system of inspection of flocks inaugurated in the Poverty Bay district has continued to give good results and has reduced the prevalence of lice-infested sheep exposed for sale. More care in dipping is being exercised, and more interest is being taken by the farmer.

The number of prosecutions for exposing lice-infested sheep for sale during the year shows clearly that much improvement is still desirable. There may be some excuse for men with small lots of sheep and no dipping facilities, but, generally speaking, the offenders are not confined to this class alone.

Development of Pig Industry.

The development that has taken place in the pig industry during the last ten years is displayed by the following figures:—

Year.	Number of Sows.	Total Pigs killed.	As Baconers.	As Porkers.
1927	69,487	380,954	268,075	112,879
1928	83,103	476,828	237,960	238,868
1929	74,692	518,025	247,292	270,733
1930	61,706	515,428	255,758	259,670
1931	64,981	525,286	212,206	313,080
1932	75,409	474,094	207,096	266,998
1933	87,686	635,282	243,820	391,462
1934	98,299	784,952	313,135	471,817
1935	111,793	936,700	346,948	589,752
1936	116,058	1,077,883	427,178	650,705

WALLACEVILLE POULTRY STATION.

This plant continues to render good service to the industry. The quality of the stock is being maintained, and the introduction of the fresh blood from New South Wales is proving beneficial. The demand for eggs for hatching-purposes, and breeding-birds, by both large and small poultry-keepers is on the increase. Five feeding-tests with some two hundred adult pullets were carried out during the year, and five similar tests with a different lot of birds are being carried out this year. The result of these tests should prove of interest and value to poultry-keepers.

HILL-COUNTRY DETERIORATION.

The Superintendent of the Fields Division writes:—

There are two major projects which in the future will require to be given more consideration than has been the case in the past. I refer particularly to the problem of hill-country deterioration in the North Island and the regrassing of the depleted tussock areas of the South Island. The deterioration of hill country in the North Island is a most serious problem of ever-growing intensity, and it is obvious that if steps are not taken immediately to investigate the causes of its deterioration, and, if possible, to effect a remedy, much valuable land which hitherto had a relatively high stock-carrying capacity will be abandoned to fern and secondary growth. Already many settlers have had to abandon their holdings, and others are merely struggling along in a fight against almost overwhelming odds. It would appear that the problem is one largely bound up with the question of such settlers obtaining easy credit for the purchase of seeds, manure, fencing, and stock to combat the weed-intrusion. Large-scale experiments in which I envisage the possibility of the Department taking control of several farms would appear necessary to secure the fullest information of how to rehabilitate this class of country.

So far as the depleted areas of the South Island are concerned, it will be recognized that the large tracts of semi-barren country, particularly in Central Otago and the McKenzie Country, require the closest investigation with a view to increasing their carrying-capacity. At one time these areas carried a wealth of natural pasture affording an abundance of feed for sheep, but with the passing of time, due largely to overstocking, rabbit-invasion, and injudicious burning, the native pastures have been woefully depleted, and to-day large tracts of virtually barren areas exist in place of the excellent native pastures of by-gone days. The striking work of the late Dr. L. Cockayne, who conducted a series of experiments on the Dunstan Mountains, has given a lead to the method by which regeneration of the tussock areas may be effected, but further extensive work in this connection requires to be carried out. The possibility of introduction of grasses and other plants adapted to the soil and climatic conditions of the tussock areas has not yet been fully exploited, and this should be done at the earliest possible opportunity. Proposals to investigate these two major projects are in hand, and it is expected that during the coming season facilities will be forthcoming to fully investigate the position.

FEED-FLAVOUR INVESTIGATION.

The following practices are confidently recommended for improving cream-quality, including the reduction of feed flavour, and at the same time increasing production :—

(1) Never hard-graze pastures for long periods, particularly in the winter and early spring. Hard grazing weakens the rye-grass and encourages white clover. Very lenient grazing in the winter and early spring, on the other hand, strengthens rye-grass by increasing its root system and weakens clovers by smothering. A system of long spells between rapid but lenient grazings should be adopted. The adoption of recommendations as above to some extent alter the normal winter feeding of stock, as winter spelling of pastures can only be successfully carried out by commencing feeding out before it really becomes necessary.

(2) Another recommendation is to top-dress in April or May about four good pastures which have been adequately phosphated and limed with sulphate of ammonia at 1 cwt. or 1½ cwt. per acre and lime at 3 cwt. per acre. These fields should be closed to stock and should be only lightly grazed in the late winter and early spring.

(3) Avoidance of the use of "night paddocks" as far as possible should be adopted, because permanent "night paddocks" slow up the "phosphate-clover-stock-nitrogen-rye-grass" process.

(4) In periods of strong feed flavour the most grassy pastures should be grazed during the day and those containing most clover during the night. In addition, cows should be kept off the clover pastures for about four hours prior to afternoon milking.

(5) Where possible, good hay should be fed when feed flavour is prevalent.

(6) At all times, but particularly in periods of strong feed flavour, attention should be paid to cleanliness and to the cooling of the cream.

ARTIFICIAL FERTILIZERS.

The practice of top-dressing pastures is a very commendable one, and all officers of the Fields Division are fully alive to the value of bringing about this practice to a greater extent than has been the case in the past, even although an increase in the amount of fertilizer and lime used is being shown from year to year.

In the South Island a definite tendency has been taking place to use basic superphosphate instead of superphosphate for pasture top-dressing. The advocates of this change-over affirm the fact that the results obtained justify the procedure, but, apart from the rights or wrong of this claim, it would definitely appear illogical to first produce a water-soluble phosphate which in the past has proved to be of the highest value for top-dressing purposes and then immediately convert it into a di-calcic form of less solubility. It has to be admitted that southern pastures in the main require liming, and, provided that top-dressing with superphosphate is preceded by liming where necessary, there would appear to be little reason in advocating basic superphosphate in place of superphosphate for top-dressing purposes. It is obvious, however, that the claims made for basic superphosphate in preference to superphosphate require the closest investigation, as does the place of basic slag and various citrate soluble phosphates, and investigations in this connection are taking place and will be extended.

CREAMERY BUTTER.

The Auckland Province continues to maintain its lead in the production of creamery butter, and of the 151,436 tons sent forward for grading, 105,287 tons were graded at the Auckland port, 119,114 tons, or 78·65 per cent., being classed as finest, 30,800 tons, or 20·34 per cent., as first, and 1,522 tons, or 1 per cent., as under first grade. The arrangement whereby all butter of lower quality than first grade is disposed of through a channel which prevents its coming into competition with the higher grades has been continued. On the whole, quality has shown a slight improvement, the average grade for the year being 93·266, as compared with 93·158 for the previous twelve-months.

The scale of prices under the Government's guaranteed-prices scheme has had a bearing on quality, and during the present season butter-manufacturers have aimed at a finished article on which the premium above the basic price is being paid. In addition, some of the advance in quality may be attributed to improved shed, plant, and farm conditions, as well as improvements in respect of dairy factories and plant brought about through the Labour Department's financial assistance by way of subsidy.

Complaints were confined principally to feed flavours and to faulty control of neutralization of acidity in cream. The practice of using starters in buttermaking is extending, and considerable difference of opinion still exists as to the advisability of using starter in the manufacture of butter. It would appear that proper conditions of preparation and considerable experience and skill in the use of starter are necessary before the practice can be safe and success assured.

The growing number of reports from the Division's officers in Britain in respect of foreign matter in dairy-produce, more particularly butter, gives cause for grave concern. The matter has been taken up with dairy companies, but unless the position improves severe steps would appear justified to remove grounds for further complaint. The majority of reports received indicate carelessness rather than accident, and in properly equipped and conducted factories there should be little excuse for either.

CHEESE.

Some 89,996 tons of cheese came forward for grading, and of this total, 18,806 tons, or 20·90 per cent., were graded as finest, 68,927 tons, or 76·61 per cent., as first, and 2,233 tons, or 2·48 per cent., as under first.

Taken as a whole, cheese-quality for the period under review must be regarded as fairly satisfactory, showing a slight improvement over the previous year. The principal faults are still openness and mould. Starter troubles were less general, though still a major problem in connection with cheese-manufacture. Apart from openness and mould, adverse reports from our London officers relate chiefly to a lack of Cheddar character and an inclination to bitterness, with harsh, mealy bodies. Broadly summed up, however, London reports were encouraging and indicate that New Zealand cheese is well received in Britain and improving its reputation from year to year.

With regard to mould, an experiment was conducted at the Wellington grading-stores to endeavour to ascertain the effect of handling on mould-development, it being considered by some that rough handling of the cheese in the factories was a likely cause. The experiment gave inconclusive results, but served to indicate that if conditions in the curing and storage rooms were properly controlled, mould was unlikely to penetrate even a cracked cheese.

GROWING OF PASSION-FRUIT.

The growing of passion-fruit on a commercial basis has been receiving considerable attention during recent years, more particularly in the North Auckland district. There has, however, been a falling off in the quantity of fruit produced during the past two seasons, due largely to the want of co-operation in the marketing of the produce. Another factor that has contributed to the past season's light crop is the incidence of disease, which demonstrates that it is essential for growers to carry out systematic spraying of the vines, this phase of the work having hitherto been practically neglected.

TE KAUWHATA HORTICULTURAL STATION.

The continuous moist weather conditions were favourable to the growth of grass and enabled more than the usual number of stock to be pastured for fattening purposes. From the sales of live-stock, wool, and skins, £401 18s. 5d. was received.

Approximately two and a half acres of scrub and wattle were cleared and sown in grass prior to being planted in vines and three and a half acres of hay harvested for stock-feeding purposes.

A late cold spring and a cool summer retarded growth in the vineyard, and this, in addition to the damage caused by the heavy storm of the previous year, resulted in the season's crop of grapes being considerably below the average. It is estimated that as a result of these unfavourable conditions the quantity of wine produced will not exceed 9,000 gallons, which is a considerable reduction on last year's figures. There has been an increased demand for wine manufactured at the Station, the total sales for the year amounting to 15,125 gallons which realized £8,031. Orders for vines and vine-cuttings showed an increase, and large quantities were sent out during the season to all parts of the Dominion. The financial position of the Station is satisfactory, receipts exceeding the general working-expenses by some £3,000.

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HONEY EXPORTS.

Quantities and values of honey exported from the Dominion during the last five years ended 31st March are as follows :

	Cwt.	Value. £
1933	2,005	7,014
1934	7,342	23,784
1935	5,427	17,844
1936	10,446	34,258
1937	7,774	24,658

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DOMINION SHEEP STATISTICS AND CURRENT SLAUGHTERINGS.

THE number of sheep (including lambs) in the Dominion on the 30th April, 1937, totalled 31,305,818 in land districts as under:—

North Auckland	1,118,738	Marlborough ..	1,130,048
Auckland	2,072,366	Westland ..	82,311
Gisborne	2,343,300	Canterbury ..	5,874,467
Hawke's Bay ..	4,127,594	Otago	3,961,751
Taranaki	712,020	Southland ..	2,650,908
Wellington ..	6,791,678		
Nelson	440,637	Dominion total	31,305,818

The monthly figures of slaughterings at meat-export slaughterhouses and abattoirs since the date given above have been tabulated, and for the period of five months, May to September inclusive, the slaughterings are as follows:—

SLAUGHTERINGS OF STOCK AT MEAT-EXPORT SLAUGHTERHOUSES AND ABATTOIRS FOR THE FIVE MONTHS, MAY TO SEPTEMBER, 1937.

——	Cattle.	Calves.	Sheep.	Of which Ewes.	Lambs.	Swine
NORTH ISLAND.						
Meat-export slaughterhouses—						
Auckland	58,992	458,027	31,568	14,637	90,844	89,874
Poverty Bay – Hawke's Bay	14,759	31,579	83,842	20,479	98,049	12,083
Taranaki-Manawatu ..	47,389	196,304	68,760	32,018	148,365	48,365
Wellington-Wairarapa	18,148	21,962	84,808	31,680	89,794	14,680
Totals	139,288	707,872	268,978	98,814	427,052	165,002
Abattoirs	54,448	21,440	155,362	93,089	9,808	36,934
North Island totals ..	193,736	729,312	424,340	191,903	436,860	201,936
SOUTH ISLAND.						
Meat-export slaughterhouses—						
Nelson-Marlborough ..	169	6,456	287	330	22,893	2,475
Canterbury	9,577	21,339	123,408	102,447	549,769	14,960
Otago-Southland ..	6,898	24,828	37,238	33,975	417,721	1,781
Totals	16,644	52,623	160,933	136,752	990,383	19,216
Abattoirs	26,792	5,401	107,599	51,109	5,901	11,892
South Island totals ..	43,436	58,024	268,532	187,861	996,284	31,108
Dominion.						
Meat-export slaughterhouses	155,932	760,495	429,911	235,566	1,417,435	184,218
Abattoirs	81,240	26,841	262,961	144,198	15,709	48,826
Grand totals ..	237,172	787,336	692,872	379,764	1,433,144	233,044

Quarterly returns are received for killings at ordinary slaughterhouses—*i.e.*, rural slaughterhouses—and for the whole Dominion the killings at these places for the first quarter ended 30th June, 1937, amount to:—

Cattle	22,513	Lambs	2,057
Calves	637	Pigs	7,311
Sheep	54,253		

PEDIGREE-SOW RECORDING.

FIRST ANNUAL REPORT FOR THE YEAR ENDING 31ST AUGUST, 1937.

UNDER the pedigree-sow recording scheme commencing from 1st October, 1936, thirty-eight breeders made use of the departmental service, placing 186 sows under test, and getting 131 completed records. The reasons for the uncompleted records are as follows: Less than four piglets alive, 26; sow dead or not in-pig, 13; withdrawn for other reasons, 10; not weighed, 5. The illness of one of the departmental officers explains the last item. Of the 131 completed records, 28 litters weighed less than 200 lb., 54 between 200 lb. and 300 lb., and 49 were better than 300 lb. at eight weeks.

Twenty-six breeders made use of the Manawatu-Oroua Pig Recording Service, getting 126 completed records. Of the completed records, 35 litters weighed less than 200 lb., 53 between 200 lb. and 300 lb., and 38 were better than 300 lb. at eight weeks old.

Eight breeders made use of the Waikato Pig Recording Club's service, getting 59 completed records out of 72 sows. Of the completed records, 13 litters weighed less than 200 lb., 26 between 200 lb. and 300 lb., and 20 better than 300 lb. at eight weeks old.

These figures converted to percentages give 24 per cent. of all litters recorded at less than 200 lb. at eight weeks, 42 per cent. between 200 lb. and 300 lb., and 34 per cent. better than 300 lb. weight at eight weeks.

The average performances of the different breeds and of all sows recorded is set out in the following table:—

Table 1

Breed	Number of Sows.	Pigs born	Pigs weaned.	Average Number of Piglets per Sow		Average Weight per Piglet	
				Born	Weaned.	At three Weeks.	At eight Weeks.
						lb.	lb.
Large Black ..	39	376	268	9·6	6·9	11·82	36·39
Tamworth ..	162	1,509	1,125	9·3	7·0	12·15	38·05
Large White ..	54	639	455	10·8	8·4	12·48	38·66
Berkshire ..	73	653	528	9·0	7·2	10·97	33·98
All breeds ..	328	3,177	2,376	9·7	7·3	11·90	36·50

It is difficult to decide how this information can now be used to best advantage—on the one hand the producers of commercial pigs are anxious to know where prolific and thrifty pigs may be obtained; on the other, it is hardly fair at this early stage to publish all results in detail, since many excellent sows have failed to show their worth, owing to unfortunate happenings that may possibly be avoided in the future. With these considerations in mind it has been decided to publish, under the owner's name, the herd-book number of every sow that attains a certain standard.

Five grades, or standards, have been adopted, as follows :—

Table 2.

Grade.	Litter-weights (Pounds) at	
	Three Weeks.	Eight Weeks
1	Greater than 120	And 360
2	Greater than 100	And 300
3	Greater than 90	And 270
4	Greater than 80	And 240
5	Greater than 70	And 210

Many sows have produced a litter of 70 lb. at three weeks, but failed to do them well up to eight weeks; others have done poorly up to three weeks and done well up to eight weeks. This is a matter for the owner, and since each owner has his records in detail he can take the necessary action to get his sows qualifying if he thinks it desirable. The dual standard may not be a just one, but it seems to be a very desirable one and is simpler than those based on the number of pigs and the weight per piglet at different ages.

In the statement following, the name and address of the breeder is given, followed by the breed and herd-book number of his sow or sows. The single number after each sow denotes the grade of litter produced. This can be interpreted from the previous table. The herd-book number of the sow serves not only to identify the sow, but gives as well a rough indication of her age, for which some allowance should be made when these figures are being considered. Sows tend to have poorer litters after the sixth or seventh. The herd-book numbers allotted to the various breeds from 1932 to 1936 inclusive will be found at the end of this publication. A sow's number appears in the herd book, as a rule, about one year after the sow is born.

List of Graded Sows.

Barnett, A. L., Leeston, Canterbury	B. 10329, 5.
Berry, A. F., and Sons, Rockville, Collingwood	T. 6011, 2 ; T. 6013, 5 , T. 4718, 5.
Boland, R. A., Crystal Brook, Longford, Nelson	L.B. 872, 2.
Candy Bros., Pokuru R.D., Te Kawa	L W. 4518, 2 ; L.W. 4670, 3 ; L.W. 4362, 3 ; L.W. 4504, 4.
Canterbury Agricultural College, Lincoln	T. 6211, 1 ; T. 6212, 2 ; T. 8949, 5 ; L.W. 4621, 1 ; L.W. 4765, 2 ; L.W. 4131, 2 ; L.W. 4430, 3 ; B. 10823, 2 ; B. 11716, 2 ; B. 11316, 5.
Telford, T. W., and Sons, Oakura, Taranaki	T. 8034, 3 ; T. 7349, 5 ; T. 5162, 5.
Unwin, S., Stoneycroft, Winchester, South Canterbury	B. 10387, 2 ; B. 10387, 2.
Warnock, Mrs. E. M., Hunt's Road, Owaka, Clutha	T. 7645, 4.
Wesley College, Paerata, Pukekohe	L.W. 4353, 3 ; B. 10844, 5.
Whitelock, D. P., Normanby, Taranaki	L.B. 892, 4 ; L.B 760, 5.
Baxter, A. J., Aorangi, Feilding	T. 4156, 2 ; T. 4156, 5.

List of Graded Sows—continued.

Buchanan, D., Tiakatahuna	L.W. 2951, 2, L.W. 2952, 5.
Burmeister, O., Kairanga R D, Palmerston North	B. 8528, 3, B. 8528, 5.
Cheetham, S.	L.B. 1539, 5.
Cheltenham Dairy Co, Feilding	T 3304, 1; T 6763, 1, T. 6761, 2; T 6764, 2, T. 8681, 3; T. 3304, 5, T. 6761, 5, B. 9344, 3; B. 8578, 4, B 10297, 5.
Christensen, O., Tokomaru	L.B. 1107, 1, L B 1540, 4, L.B. 1314, 5
Clausen, O. V., Foxton Line, Palmerston North	B 9565, 5
Davison, W.	L.W. 4215, 2.
Fieldhouse, H. E, Rongotea	B 10811, 2, B. 10811, 4, B. 10699, 4, B 10699, 5; T. 2448, 3
Feilding High School, Feilding	T. 4514, 3, L B 1519, 4, L W. 4599, 5
Hansen, N. E, Palmerston North	T. 6425, 5.
Hunt, C. S, Glen Oroua	T 5625, 1, T 3938, 2, T 5511, 2, T 8158, 3; T. 3327, 4, T. 3937, 5; T 5625, 5, B 11570, 4
Johnston, D. T, Kauwhata	T 7573, 4
Keiller, B. E, Palmerston North	L.W 3552, 1, L W 4459, 1, L W. 2916, 3
Leamy, P., Kairanga, Palmerston North	T 3928, 4
Lyons, G., Kopane R D, Palmerston North	B 10188, 5
Massey Agricultural College, Palmerston North	T. 7059, 2, T 7201, 2, T. 7203, 3, T. 7261, 4, T 3615, 4, T 3101, 4, T 7059, 4, T 8834, 4, T. 8518, 4, T 8833, 5, T. 8836, 5, T 8301, 5
Pedersen, N, Kauwhata, Palmerston North	L B. 1109, 2, L B 1100, 2
Price, R	T 7516, 2
Russell, J. A., Blythewood, Gillespie's Line, Palmerston North	B 11369, 4, B 10035, 5
Scott, W. C., Glen Oroua	T 5274, 3, T 7100, 4; T. 8479, 5.
Childs, J F, Champion Road, Richmond, Nelson	L W 3752, 2
Clark, A S., Pokuru, Te Kawa	T 5714, 1, T 5714, 2
Cloke Bros, Lepperton, Taranaki	B. 11082, 2, B 10308, 3
Golder, G A, Nireaha, Eketahuna	T 7375, 2
Gillett, G E., Sefton, North Canterbury	T. 6176, 2, T 6775, 2; T 7729, 2; T 7729, 4, T. 7730, 4; T. 8295, 4, T 4995, 5; T. 4994, 5
Griffin Bros., Richmond, Nelson	T. 7755, 5
Guddop, A. R., Cowling Road, New Plymouth	T 6747, 2, T 6939, 3; B. 10830, 3.
Hoey, J., Kama, Whangarei	T. 5349, 1
Larsen, O. C., Umutaoroa, Dannevirke	B. 10163, 2, B 11409, 4, B. 11102, 4, B 11101, 5
Lepper, M H., York Road, Midhirst, Taranaki	L.W. 4550, 1, L W. 2687, 1; L.W. 3826, 1, L W 3825, 2; L W. 2688, 2, L.W 4549, 2; L W. 4647, 4
Mellsop, R., Matatoki, Thames	T. 7954, 5.
Ogle, F., Austin Road, Normanby, Taranaki	T. 7194, 2; T. 5536, 4; T. 5536, 5; T. 3209, 5.
Oliver, Mrs. A. B., Kelly Road, Lepperton, Taranaki	L.B. 1157, 2; L.B. 1404, 3; L.B. 1271, 3; L.B. 1402, 4; L.B. 1271, 4; L.B. 1158, 5.
O'Sullivan, A. M., Cardiff, Taranaki	L.B. 962, 1; L.B. 1387, 5.
Otago Central Pig-breeders' Club	L.W. 4641, 2; L.W. 4641, 4.
Preston, H. H., Harrisville	L.W. 3646, 4.
Rayner Bros., Patumahoe, Franklin	L.W. 4726, 4.

List of Graded Sows—continued.

Rose, V. C., Otira R.D., Invercargill	L.B. 1234, 4.
Simpson, J. S., Southbridge, Canterbury	T. 8498, 2 ; T. 6699, 5.
Stewart and Kerr, Onewhero, Tuakau	T. 7407, 1 , T. 7408, 5 ; T. 8693, 5 ; B. 10306, 5.
Stratford Technical High School, Stratford	T. 7921, 1 ; T. 7046, 2.
Suter, E., Waiau Pa, Pukekohe	T. 4450, 2 ; T. 9029, 5.
Taylor and Sons, Ngaere R.D., Stratford	B. 10772, 1 ; B. 10772, 2 ; B. 11808, 4.
Whitelock, G. M., Newbury, Palmerston North	L.W. 2486, 2 ; L.W. 4546, 2 ; L.B. 1265, 2 ; L.B. 1245, 2 ; L.B. 1320, 2 ; L.B. 508, 4.
Williams, W. M., Fitzherbert West R.D., Palmerston North	T. 7721, 2 ; T. 8223, 2.
Annett, H. E., Matangi, Hamilton	T. 4935, 1 ; T. 6290, 2 ; T. 6290, 2 ; T. 4935, 2.
Barton, G. H., Whatawhata, Hamilton	T. 5784, 3 ; T. 4557, 3 ; T. 7108, 4 ; T. 5785, 5.
Burwen, Ltd., Te Rapa, Hamilton	T. 8026, 2 ; T. 8461, 3 ; T. 8382, 4 ; T. 8210, 4 , T. 5494, 4 ; T. Wallinger Sunbeam, 5 ; B. 11630, 1.
Chilcott, R., Te Rapa, Frankton Junction	B. 9705, 2 ; B. 10998, 2 ; B. 10352, 3 ; B. 10349, 3 ; B. 11307, 5 ; T. 3570, 2 ; T. 3570, 2.
Jones, E. J., Eureka, Hamilton	T. 6286, 1 ; T. 6349, 3 ; T. 6286, 4 ; T. 8307, 4 ; T. 8462, 4 ; T. 8156, 4 ; T. 8309, 5.
Masters, L., Eureka, Hamilton	L.B. 1417, 4.
Parsons, J. E., Pukeroro R.D., Hamilton	L.W. 4144, 1 ; L.W. 4571, 1.
Porrit, G. D., Pukeroro R.D., Hamilton	L.W. 4154, 1 ; L.W. 4582, 1 ; L.W. 4156, 1 ; L.W. 4156, 1 ; L.W. 4514, 1.

Herd-book Numbers.

Year.	Berkshire.	Large White.	Tamworth.	Large Black.
1936	11858	4740	8883	1513
	11001	4557	7764	1348
1935	11000	4556	7763	1347
	10292	4242	5879	1131
1934	10291	4241	5878	1130
	9740	3707	4191	874
1933	9739	3706	4190	873
	9259	3114	3323	752
1932	9258	3113	3322	751
	8851	2256	2900	603

Montgomery red clover has done very well where used in Southland, particularly as a haying proposition. Where included in permanent pasture mixtures, however, very little is seen after the third year. A noticeable feature is that this plant is not grazed by rabbits, probably on account of its hairy leaf.

BORERS IN FRUIT-TREES.

L. J. Dumbleton, Assistant Entomologist, Division of Entomology, D.S.I.R., Nelson.

The incidence of injury to fruit-trees caused by insects boring into the roots, stem, or branches is not of a very widespread or serious nature in New Zealand, except perhaps in the case of citrus trees. Nevertheless, a number of insects have been recorded as boring in fruit-trees, and it is the purpose of this note to furnish what information is available on their habits and on possible methods of controlling them.

The insects recorded here are native species. One is the caterpillar of a moth and the others are the grubs or larvæ of longhorn beetles. A distinction may be made between those insects which bore into living wood, thus doing serious damage to the tree, and those which bore in wood which is dead and dry and do not usually extend their depredations into the green wood. In the first group come *Charagia virescens, Oemona villosa,* and possibly also *Navomorpha lineatum* and *Navomorpha sulcatum*. In the second group come *Xyloteles griseus* and *Xyloteles laetus*.

Description and Habits of the Insects.

The ghost moth (*Charagia virescens*) is the largest of the native moths, having a wing span of 4 in. or more. The general colour is green with paler and darker markings. The moth itself is not often seen unless it flies into lights in a house. Moths are flying from September to November. The habits of the insect are not well known, but it is assumed that the eggs are laid on the ground and that the young caterpillars hatching from them climb the trees and commence boring in a favourable position. The duration of the caterpillar stage is probably more than three years, and it grows to a length of 3 in. The presence of this insect may readily be diagnosed by the silken web or curtain, resembling the bark in colour, which conceals the mouth of the burrow. Under this is a shallow excavation, and from it a burrow leads off on each side round the side of the limb, while a third burrow extends inward toward the centre of the limb and then vertically downward for perhaps 6 in. In the case of well-grown caterpillars these tunnels may be ⅜ in. in diameter. The insect, whether in the caterpillar or chrysalis stage, is usually to be found in this vertical burrow. The species is not present in the South Island. A large number of native and exotic trees are attacked by this insect. Injury to fruit-trees is probably more common in districts where patches of bush or native vegetation are close to the orchards. Cases of damage to apple, peach, nectarine, and lemon trees have been recorded.

The Lemon-tree Borer (Oemona villosa).—This longhorn beetle is sometimes known as *Aemona hirta*. The beetle has the long antennæ which are characteristic of longhorn beetles. The body measures up to 1 in. in length and is more or less parallel sided. The general colour is brownish with a clothing of short, golden hair. The life-history of this insect has not yet been carefully studied. The beetles have been noted to emerge in the spring. The female lays her eggs on dead or exposed wood, such as a branch stub or a place where the bark has been removed. The eggs are affixed to the wood and the young grub bores through the egg-shell and into the wood. Having gained entry through the dead wood, the grub then bores into the living or green wood and commences to make an extensive burrow. The duration of the grub stage is not known, but it is probably more than one year. The grub is similar in appearance to a small " huhu " grub, and when fully grown it may be slightly over an inch in length, cylindrical, white or creamy in colour, and without well-developed legs Besides boring up or down the centre of the branch the grub frequently cuts a circular burrow round it under the bark and so weakens the branch that it bends or breaks easily. The presence of the insect may be detected by small holes in the bark through which grass or wood particles are ejected. When ready to pupate or transform to the chrysalis stage the larva plugs the tunnel in front and behind it with shreds of wood. In this cell it changes to the chrysalis stage, and a few weeks later the bettle emerges. The grubs of this species are difficult to separate from those of *Navomorpha*, although the beetles are quite distinct. The grubs are found boring in a large number of native and introduced trees and they have been recorded from apple, lemon, and almond trees. Injury by this species seems to be of common occurrence in lemon trees.

The Douglas Fir Longhorn (Navomorpha lineatum).—This longhorn beetle is similar in habits to the preceding one. The beetle is easily distinguished. It is dark red in colour, with white stripes The length of the body is about ¾ in. The beetles are flying from November to January. The grub is similar to that of *Oemona*, but usually longer and more slender. The fully developed larvæ may be 1½ in. in length. The method of gaining entry and the nature of the burrows are similar to that of *Oemona*. The grub of this insect bores into living wood, whereas that of a related species, *Navomorpha sulcatum*, usually bores only in dead wood. *N. lineatum* commonly damages Douglas fir in the North Island, the eggs often being laid on the wounds made by oviposition scars of the cicada. While there is no definite record of the species from fruit-trees it is felt that the species was concerned in a large number of cases of injury which have been attributed to *N. sulcatum*, owing to their similarity in the grub stage.

The Pine Longhorn (Navomorpha sulcatum).—This beetle is generally similar to, but smaller in size than, the preceding one, reaching about ½ in. in body length. The red colour is not so distinct and the white stripes occupy relatively more space. The beetles have been recorded as emerging in August. The egg-laying habits are similar to those of the preceding two species, but the grubs seem to confine their activities to dead, dry wood. The duration of the grub stage is not known. The grubs when fully developed may be ¾ in. in length. As far as is known the species does not usually bore in living wood and does not make the circular tunnels under the bark which weaken the branches. This species is found in a number of native and exotic trees and has been recorded from apple and almond trees.

Xyloteles griseus has been called the fig longhorn. The beetle is $\frac{7}{16}$ in. in length, brown in colour, with two or three small patches of yellow hairs on each side of the body. The beetles emerge in December and January. The female, with her mandibles, bores a hole in the bark and inserts her egg between the bark and the wood. The grubs bore at first between the bark and the wood, but later enter the wood. The activities of the grub are confined to dead, dry wood. The length of the grub stage is not known. The grub, when fully fed, is slightly over ½ in. in length. It transforms to the chrysalis in a cell in the burrow. This insect bores in a number of native and exotic trees and is sometimes found in mummied apples.

Xyloteles laetus is a closely related species of similar appearance and habits to the preceding one.

METHODS OF TREATMENT.

It is not known whether there are any conditions which predispose a fruit-tree to attack by *Charagia*. It is possible that it may attack perfectly healthy trees. In the case of the longhorn beetles *Oemona* and *Navomorpha*, however, it is known that the point of attack is through dead wood in a pruning-scar, branch stub or wound. In cases where these insects are commonly present in an orchard it will be advisable to remove all dead wood and seal pruning scars and wounds with some material such as white lead or grafting wax.

Injury by *Charagia* may be readily diagnosed by the silken curtain which covers the entrance to the burrow. In most cases it will be possible to destroy the caterpillar or pupa by probing the burrows with a copper wire. When the operator is satisfied that the caterpillar has been destroyed the openings of the burrows may be sealed with putty or grafting wax and the wound painted over with white-lead. Whenever it is possible, the damaged wood should be cut out of the tree, but it may not be possible to do this in the case of *Charagia*, which is commonly found in the trunk or in large branches.

The burrows of the longhorn beetles *Oemona* and *Navomorpha* are frequently so twisted that it may be impossible to kill the grubs by probing with a copper wire. These two insects commonly attack the smaller branches, and damaged wood may often be cut out. Where it is not possible to cut out the infested wood or to kill the grub *in situ* with a copper wire it may be necessary to inject some insecticide into the burrow. A number of materials have been used for this purpose, but the use of many of them is often followed by injury to the tree, and until more information is available on the effect of the insecticide on the tree it is best to avoid this method of treatment. Calcium and potassium cyanide seem to be definitely unsafe to use as they may kill the cambium and bark above and below the point of application, when injected into a hole or applied to exposed wood. Para-dichlorobenzene also has been reported as injuring trees. These substances mixed with various oils are used to some extent in the United States of America for the control of a longhorn beetle in apple, but they are not applied to exposed wood or injected into the burrows. No information exists on the effect of carbon bisulphide when injected into the burrows. The use of kerosene and petrol is sometimes advocated for killing grubs, but as these may have a toxic effect they had better not be used. Probably the safest type of insecticide to use is a plant product such as nicotine or derris. Of these two the nicotine is probably more efficient as it may act as a fumigant in cases where the liquid does not actually come in contact with the grub in the burrow. Even in the case of nicotine it is possible that it may have some toxic effect on the plant when injected into the burrows of the grubs.

PRICE-LIST OF WINES

made at

TE KAUWHATA HORTICULTURAL STATION.

WINE IN CASE.

(A case contains 12 reputed quarts—2 gallons.)

Delivery ex Departmental Store, Auckland, Wellington, Christchurch, and Dunedin.

FRONTIGNAC (sweet red)	30s. per case.
MADEIRA (sweet white)	30s. per case.
ASSORTED CASES OF THE ABOVE	30s. per case.

Delivery f.o.r. Te Kauwhata.

FRONTIGNAC (sweet red)	30s. per case.
MADEIRA (sweet white)	30s. per case.
CLARET (dry red)	25s. per case.

(Any assortment of the above can be packed to a case if required.)

WINE IN BULK.

(From Te Kauwhata only.)

FRONTIGNAC and MADEIRA can be supplied in bulk if required, provided suitable containers are supplied by the purchasers, but not otherwise. (Bottles not accepted; kegs or jars only.) Freight on containers forwarded for filling must be prepaid. Bulk rates are as follows:—

2 gallons	10s. per gallon (£1).
5 gallons	9s. 6d. per gallon (£2 7s. 6d.).

(Rates for larger quantities supplied on application.)

PLACING OF ORDERS, AND CONDITIONS OF SALE.

Orders should be forwarded to any one of the following. Manager, Horticultural Station, Te Kauwhata; Director, Horticulture Division, Department of Agriculture, Wellington; District Chief Clerk, Department of Agriculture, Auckland,; District Clerk and Accountant, Department of Agriculture, Christchurch and/or Dunedin.

Minimum quantity sold, 2 gallons. Cheques payable to "Department of Agriculture," and crossed "Public Account." Orders cannot be accepted unless accompanied by a remittance covering the price of the wine, and the exchange when drawn on banks outside Auckland, Wellington, Christchurch, and Dunedin. All freight to flag stations and ports beyond the railway must be prepaid. Under the Licensing Amendment Act, 1914, wine cannot be sent into a no-license area excepting on an "order signed by and stating the address and occupation of the purchaser thereof."

INTERPOLLINATION OF BRASSICAS.

ITS SIGNIFICANCE IN RELATION TO SEED-PRODUCTION.

R. A. CALDER, Agronomy Division, Lincoln

THE intercrossing which may take place between such brassica forms as rape, turnips, and swedes is a matter of some concern to growers who raise these crops for seed and to the merchants who contemplate handling this seed in commerce

An investigation relative to this phase of seed-production was conducted by the Agronomy Division for the purpose of attempting not only to determine the propensity the three forms have for cross-fertilization, but also to indicate the influence of such on the immediate progeny.

CROSS-FERTILIZATION STUDIES.

Rape, turnips, and swedes each belong to distinct species or subspecies, and, although to some extent capable of self-fertilization, set seed more freely consequent upon cross-fertilization between individuals of the same species

Cross-fertilization may also operate in certain instances between distinct species. Sutton(1), in reference to interspecific crosses, which he himself carried out, proved that " while no variety derived from *Brassica oleracea* (cabbage, thousand-headed kale, kohl rabi) was affected by the pollen of rape, swede, or turnip, and *vice versa*, yet all types of *B oleracea* would freely intercross between themselves, and this was equally true of many varieties of rape, swede, and turnip "

Roemer(2) crossed swedes (" *Rutabaga - Brassica Napus rapifera* ") with kales and cabbages (*B oleracea*). Fertile hybrid plants were obtained when the swede was used as the female parent; no successes were secured from reciprocal crosses.

Nelson(3) mentions the work of a number of investigators who acknowledge the ability of rape, turnips, and swedes to intercross, but from his own work concludes that differential fertility is to be found between these forms.

The evidence obtained from trials conducted by the Agronomy Division is in accordance with the views of Sutton and Nelson.

The forms used in the investigations were :—

(1) Rape (*Brassica napus* L.).
(2) Turnip, white flesh (*B. rapa* L.).
(3) Swede, yellow flesh (*B. napobrassica* Mill.).
(4) Wild turnip (*B. campestris* L.).
(5) Chou moellier or marrow-stemmed kale (*B. oleracea* L.). This was included as it is an important farm crop belonging to the species *B. oleracea*.

These were cross-pollinated reciprocally by hand; wild turnip was used as the male parent only. The results are recorded in Table I.

Table I.—Shows the Response in Number of Pods formed and in Number of Seed set due to Interpollination of some Brassica Species.

Female Parent.	Male Parent.	Flowers pollinated.	Number of Pods formed.	Number of Seed set.	Percentage of Pods set.	Average Number of Seed per Pod.	Appearance of Seed.
Giant rape ..	Turnip ..	40	34	41	85·0	1·2	Well developed, good colour.
	Swede .	96	69	767	72·0	11·1	Ditto.
	Wild turnip ..	30	20	80	66·6	4·0	,,
	Chou moellier	56	23	0	41·0	0	..
Broad-leaf Essex rape	Turnip ..	42	31	431	73·9	13·9	Well developed good colour.
	Swede ..	65	58	932	89·3	16·1	Ditto.
	Wild turnip ..	31	22	77	71·0	3·5	,,
	Chou moellier	18	0	0	0	0	..
Turnip ..	Giant rape ..	27	16	154	59·3	9·5	Shrivelled, reddish colour; tendency to germinate in pod; seed-coats split.
	B.L.E rape .	32	19	277	59·4	14·6	Ditto.
	Swede .	192	140	1,021	73·0	7·3	,,
	Wild turnip .	35	35	373	100·0	10·7	Well developed, good colour.
	Chou moellier	94	0	0	0	0	
Swede ..	Swede ..	1,048	768	12,441	73·3	16·2	Well developed, good colour
	Giant rape .	96	86	1,659	89·6	19·3	Ditto
	B.L.E. rape ..	103	93	1,945	90·2	20·9	,,
	Turnip .	169	104	1,358	61·6	13·0	,,
	Wild turnip .	39	27	71	69·2	2·6	Most well developed, good colour, some shrivelled
	Chou moellier	60	23	0	38 6	0	..
Chou moellier or marrow-stem kale	Chou moellier	255	162	3,189	63·6	19·7	Well developed, good colour.
	Self-pollinated	281	127	246	45·2	2 0	Ditto.
	Giant rape .	64	23	0	36·0	0	.
	B.L.E. rape ..	51	16	0	31 2	0	.
	Turnip	89	57	0	64 0	0	.
	Swede ..	191	75	0	39·3	0	
	Wild turnip ..	43	5	0	11 6	0	

Comments on Table I.

(1) It may be noted that some seed has been obtained from all crosses, with the exception of those where chou moellier has been used as one of the parents. Rape, turnip, and swede may be readily cross-fertilized.

(2) With seed or rape as the mother plant the seed harvested was well developed and of a good, dark colour; with turnip as the mother plant the seed was shrivelled, of a poor reddish colour, and tended to germinate in the pods; the seed-coat in many cases was split.

Somewhat similar observations were recorded by Sutton and Nelson.

(3) In some of the chou moellier crosses pods developed, but contained no seed. This fruitfulness accompanied by sterility is by no means unusual. Nelson draws attention to the occurrence and terms the seedless fruits " false pods."

(4) Wild turnip crosses readily with all forms excepting chou moellier. The seeds per pod are generally few, but they are well developed.

(5) Chou moellier exhibits some degree of sterility when selfed. Crossing resulted in 19·7 seeds per pod, selfing in 2·0 seeds per pod.

These results were obtained when the different types were artificially interpollinated. As it was of interest to determine whether cross-fertilization could occur naturally, the following procedure was adopted :—

Natural Cross-pollination.

Rape, turnip, and swede plants were grown in close association, and for a period all flowers, other than those covered subsequent to hybridization, were exposed and available for interpollination ; this was possible between members either of the same or of distinct species. The pods which developed from these flowers were harvested separately, and in the following season the seed was sown to determine, as far as possible, the degree of natural interspecific pollination which had occurred. The following results were obtained :—

(*a*) From swede open-pollinated in the presence of rape and turnip, sixty-three plants attained full development ; of these, twenty-five were recognized as Swede × Rape, the balance resembling pure swedes.

(*b*) From turnip open-pollinated in the presence of swede and rape, twenty-five plants attained full development. Of these, seventeen resembled the Turnip × Swede, and eight the Turnip × Rape hybrids. Only one turnip plant had in the previous season reached the flowering-stage. As this one plant failed, unaccountably, to produce seed on self-pollination, it follows that all seed formed must necessarily have arisen as a result of pollination by other species.

(*c*) From rape open-pollinated in the presence of swede and turnip, fifty-five plants attained full development ; all resembled normal rape.

Although no definite explanation can be offered for the non-appearance of turnip hybrids in (*a*) or for the apparent absence of any hybrid plants in (*c*), it is evident that when rape, turnips, and swedes are grown in close association a certain amount of natural cross-pollination can occur. No evidence was obtained as to what the extent would be, consequent upon wider spacing. English seed firms advise at least a quarter of a mile between distinct species or varieties.

HYBRID FORMS.

Crops grown from commercial seed of rape, swede, and turnip are, as a rule, remarkably free from types indicative of contamination by " foreign " pollen. Nevertheless, such off-types are occasionally observed, and a knowledge of the appearance of hybrid forms of known parentage should be helpful to the seed-grower in enabling him to identify such plants.

Before describing the various hybrid forms, mention should be made of the manner in which certain characters are transmitted ; such information may prove to be of some use in determining the probable source of " foreign " pollen and in indicating the precautions that must be made in future years.

Rapes, swedes, and turnips each possess certain characteristics which serve to distinguish them.

Table II.—Some Distinguishing Characteristics of Rape, Swede, and Turnip

Species.	Skin-colour.	Flesh-colour.	Flower-colour.
Rape—			
Giant	White	White	Bright lemon-yellow.
B.L.E.	White	White	Paler yellow than giant.
Swede	Purple		
	Bronze	(1) White	Bright lemon-yellow.
	Green	(2) Yellow	Dull buff-yellow.
Turnip	White		
	Green	(1) White	Bright lemon-yellow.
	Red		
	Purple (green + red)	(2) Yellow	Dull buff-yellow ; paler than swede.

When two individuals possessing contrasting characters are crossed the immediate or first progeny will generally exhibit only one of these characters; that observed in the first generation is referred to as the dominant character.

The observations made at this Station confirm those made by Davey(4), and may be summarized as follows:—

(1) White flesh is dominant over yellow flesh.

(2) A bright lemon-yellow flower-colour is associated with white flesh, and a dull yellow-buff colour with yellow flesh. In a flowering crop, therefore, it is sometimes possible to locate certain rogues by flower-colour; bright lemon-yellow flowers indicate roots with white flesh, and yellow-buff flowers roots with yellow flesh.

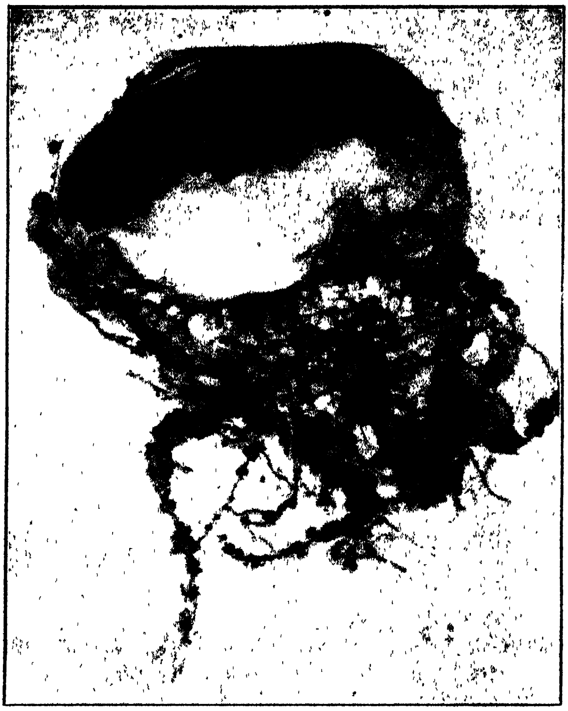

FIG 1. LINCOLNSHIRE RED TURNIP × GRAND MASTER SWEDE SHOWS FORMATION OF HYBRID NODULES NOT CLUB-ROOT

(3) Green skin-colour and red skin-colour are independent of one another, but when associated together in the one plant produce a purple effect. By scraping away the red of purple roots the green may be observed beneath. Both green and red are dominant over white skin.

(4) An additional point of interest is that the roots of hybrids obtained by crossing turnips and swedes are characterized by irregular knoblike swellings similar in appearance to those caused by the disease known as "club-root." They are termed hybrid nodules (Fig. 1).

The practical significance of these facts will be appreciated by an observer when endeavouring to determine the probable source of pollen-contamination.

APPEARANCE OF HYBRID FORMS

(NOTE.—In each cross the mother plant is mentioned first.)

1. (*a*) *B.L.E. Rape* × *Yellow flesh Swede.*

Foliage.—Abundant, rape-like in appearance, dense, and erect; short central stalk with numerous side branches. Leaves: Similar to those of rape. Colour: Greyish-blue, green.

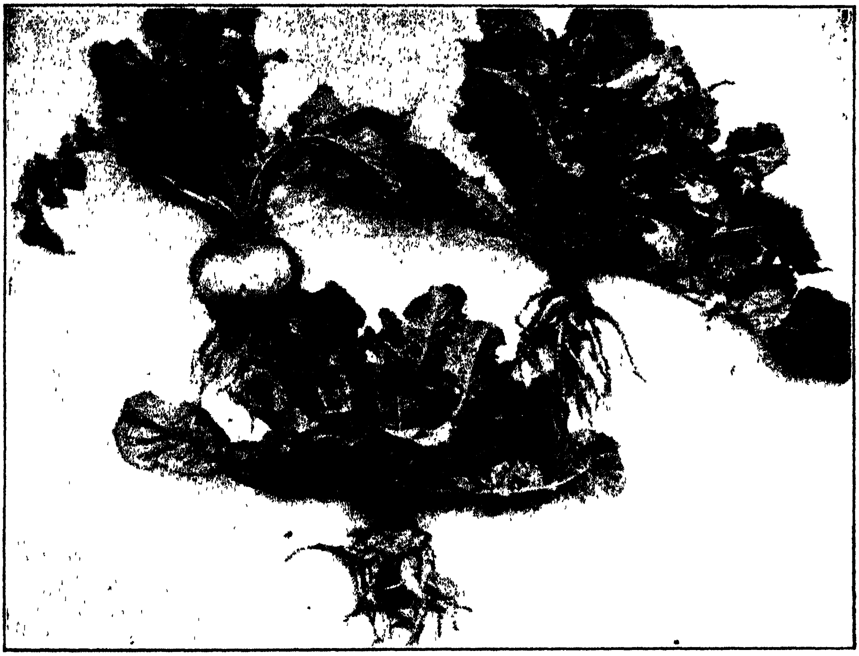

FIG. 2. TOP LEFT, GRAND MASTER SWEDE; TOP RIGHT, BROAD-LEAF ESSEX RAPE; BOTTOM, SWEDE × RAPE.

Bulbs.—Slightly developed, misshapen, and very fangy. Flesh: White or greyish in colour and rather woody. No colour in exposed surface. A pronounced neck is evident, the scars of which are slightly tinged with purple, as are the bases of the side stalk. No marked development of nodules.

Flower-colour.—Yellow.

1. (*b*) *Yellow-flesh Swede* × *B.L.E. Rape* (Figs. 2 and 7).

Foliage.—Varies between that of rape and swede; greyish-blue-green in colour with the stalks in some cases tinged with purple. Shape and appearance of leaf also varies between that of rape and swede.

Bulbs.—Small to medium sized, generally uniform in shape, but extremely fangy. Flesh: White in colour and woody. No colour in exposed surface. A pronounced neck, the upper scars of which are coloured purple, as are also the bases of the side stalks. No appearance of nodules.

Flower-colour.—Yellow.

2. (*a*) *Yellow-flesh Swede* × *White-flesh Turnip* (Figs. 3 and 7).

Foliage.—Intermediate in appearance between that of both parents, the colour of some plants tending more towards the bright-green colour of turnips, while that of others is the greyish tinge of swedes. Shape of leaf and habit of growth are more like those of swede than of turnip.

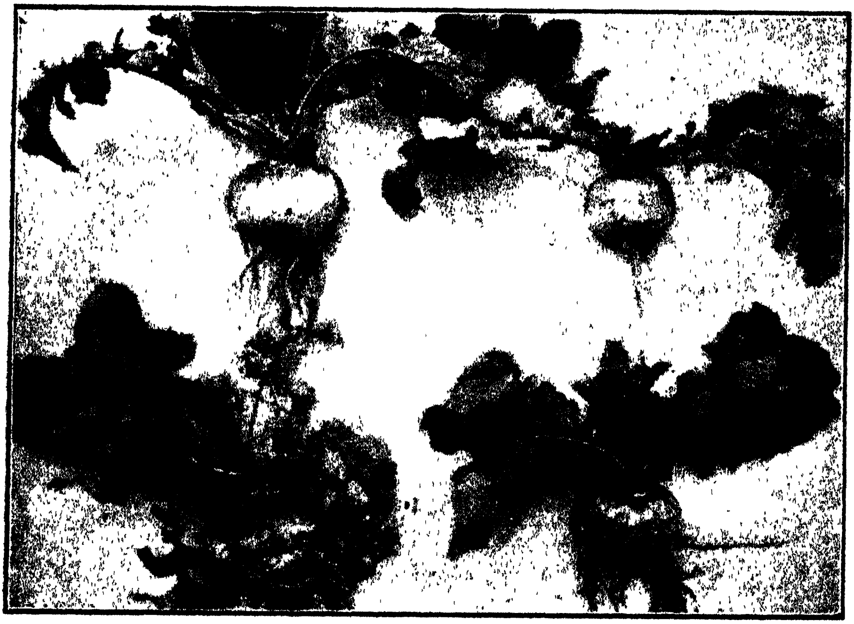

FIG. 3. TOP LEFT, GRAND MASTER SWEDE; TOP RIGHT, LINCOLNSHIRE RED TURNIP; BOTTOM LEFT, TURNIP × SWEDE; BOTTOM RIGHT, SWEDE × TURNIP.

Bulbs.—Medium size, misshapen, fangy, slight neck-development. Flesh: White in colour and firm in consistency. Exposed surface: Generally without colour. Neck scars: Usually purple. Small bulbous nodules similar to those of club-root, but identified as not being such, are present on the roots; are termed hybrid nodules.

2. (*b*) *White-flesh Turnip* × *Yellow-flesh Swede* (Fig. 3).

Foliage.—Rather abundant, tending more towards the appearance of turnip than of swede; bright-green in colour, with shape and habit similar to those of turnip.

Bulbs.—Medium to large, misshapen, fangy, with slight neck-development. Flesh: White in colour and of a firm consistency. Exposed surface: Purple in colour with an uneven green band round lower margin. Neck scars: Purple; this colour is continued as a tinge into the stalks. Marked nodule development (Fig. 1).

Flower-colour.—Yellow.

3. *White-flesh Turnip* × *B.L.E. Rape* (Figs. 4 and 7).

Foliage.—Short, dense, bright-green in colour, similar to rape in habit, but with colour of turnip. Leaves: Medium length, rather narrow, with fair lobe-development; no colour in stalk.

Bulbs.—Practically no development; only a small woody swelling; very fangy. Flesh: White in colour. No colour in exposed surface. A short stout neck, from which numerous side stalks arise. No nodule development.

Flower-colour.—Yellow.

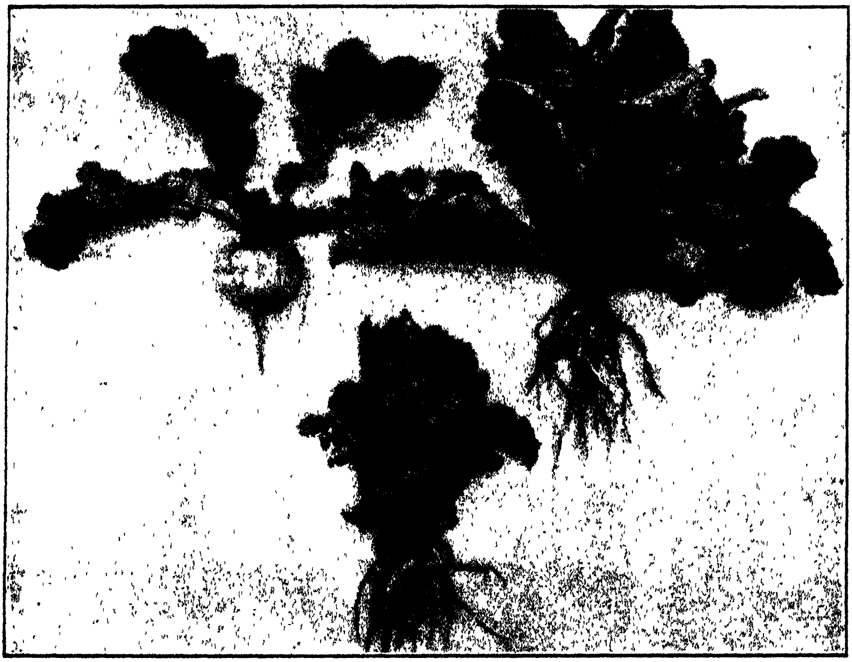

FIG. 4 TOP LEFT, LINCOLNSHIRE RED TURNIP; TOP RIGHT, BROAD-LEAF ESSEX RAPE; BOTTOM, TURNIP × RAPE.

.4. *Yellow-flesh Swede* × *Wild Turnip (white flesh)*, (Figs. 5 and 7).

Foliage.—Scanty but vigorous, intermediate in appearance between swede and wild turnip, but tending more towards the wild turnip. Leaves: Rather large, semi-erect, and much lobed. Stalks: Purplish-red in colour.

Bulbs.—Medium to large in size, generally a little flattened, being wide from side to side in one direction; set rather deeply in the ground; very fangy. Flesh: White in colour, with a firm consistency. Exposed surface: Reddish-purple in colour, with a slight green band. Neck-development variable, scars purple, which colour is continued on into stalk. Distinct nodule development.

Flower-colour.—Yellow.

5. *White-flesh Turnip* × *Wild Turnip (white flesh)*, (Figs. 6 and 7).

Foliage.—Prostrate and bright-green in colour. Leaves of a medium size and much lobed ; stalk purplish. A few plants developed seed-stalks.

Bulbs.—Development poor ; small to medium size, misshapen and fangy. Flesh : White in colour, with a firm fleshy to woody consistency. No colour in exposed surface. Practically no neck. Scars of crown tinged with purple, which colour is continued into stalks. Distinct nodule development.

Flower-colour.—Yellow.

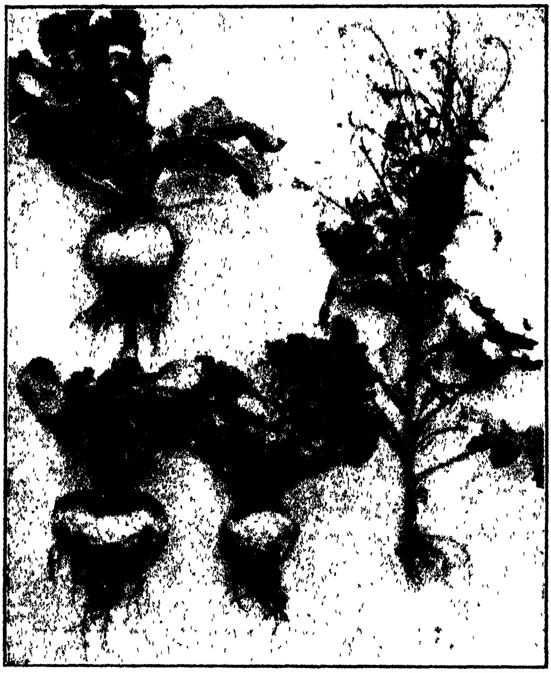

FIG. 5. TOP LEFT, GRAND MASTER SWEDE ; RIGHT, WILD TURNIP ; BOTTOM LEFT, TWO ROOTS OF SWEDE × WILD TURNIP.

APPLICATION OF THE RESULTS.

It is evident that cross-pollination with subsequent fertilization can be effected quite readily between rape, turnips, and swedes. The results, however, afford no definite indication as to the actual contamination which may occur in the field when two or more distinct forms are grown within short distances of one another. Under these conditions certain limitations may influence the issue :—

(1) The forms may flower at different times. If there is no overlapping of the flowering periods no cross-pollination can occur.

(2) Generally speaking, the pollen from plants of a certain form is more effective on individuals within that form than on those of a different form.

(3) When an area consists of numerous plants of one form all growing in close association the superabundance of the "home" pollen should restrict the effect of "foreign" pollen.

(4) The prevailing wind may predispose the flight of insects carrying pollen to a particular direction.

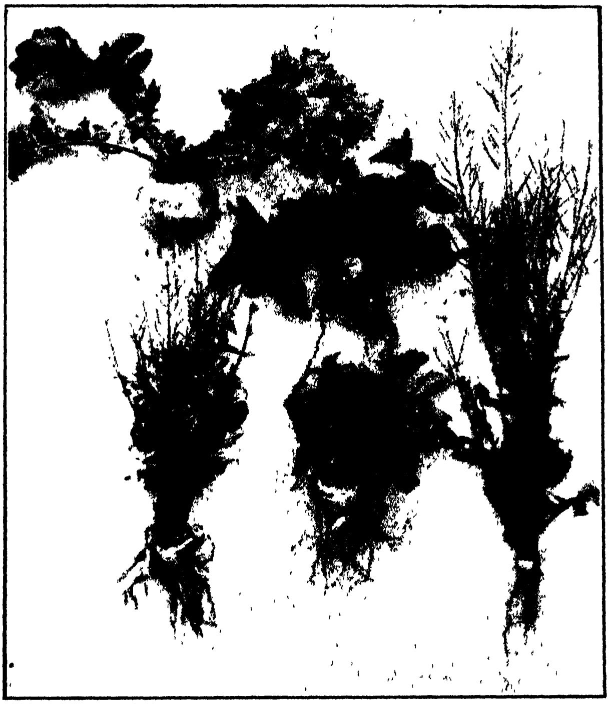

FIG. 6. TOP LEFT, LINCOLNSHIRE RED TURNIP. OTHER SPECIMENS REPRESENT A RANGE OF TYPES OBTAINED FROM TURNIP × WILD TURNIP; THE WILD TURNIP PARENT HAS NOT BEEN INCLUDED.

Despite these limitations and in view of the fact that hybridization can and does occur, distinct forms and varieties when grown in the same vicinity should always be strictly isolated one from the other. If such a precaution is taken, and provided any casual wild turnips are eradicated, a grower can be more definitely assured of producing a seed crop, the progeny of which should exhibit a satisfactory degree of purity.

CONCLUSION.

Interspecific cross-pollination, with subsequent fertilization, can be effected artificially, and also takes place naturally between rape, swedes, turnips, and wild turnips. The progeny of these inter-relationships is generally inferior to the parental forms, and consequently in the production of these seeds every effort should be made to prevent the incidence of foreign pollen. No seed was obtained when chou moellier was crossed with any of the above forms.

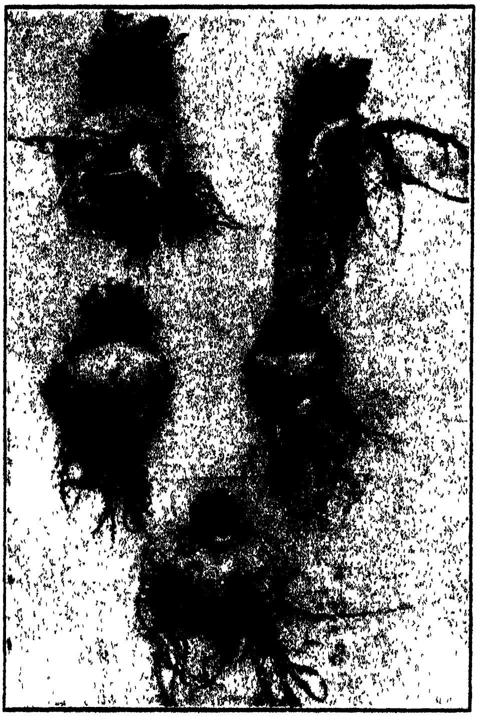

FIG. 7. TOP LEFT, SWEDE × RAPE; TOP RIGHT, TURNIP × RAPE; MIDDLE LEFT, SWEDE × WILD TURNIP; MIDDLE RIGHT, TURNIP × WILD TURNIP; BOTTOM, SWEDE × TURNIP.

ACKNOWLEDGMENT.

This work was suggested by, and carried out under the direction of, Mr. J. W. Hadfield, Director, Agronomy Division, Lincoln.

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FRUIT-CROP PROSPECTS.

THE Director of the Horticulture Division has received the following reports from his officers regarding the fruit-crop prospects at the end of October, 1937 :—

Auckland.—Apples : Heavy blossoming and a good setting Gravensteins light. Lemons : Blossoming freely. Nectarines : Poor setting. Oranges : Poorman blossoming freely Peaches : Light setting. Pears : Heavy setting most varieties. Plums : Generally light Strawberries : Medium crop. Rain needed. Tomatoes : Hothouse good crops. Heavy plantings of outdoor varieties.

—*L. Paynter.*

Tauranga.—Apples : Dunn's and Dougherty patchy Promise of good average crop other varieties Apricots : Light to very light Gooseberries and pears : Good Lemons : Promise of good main blossoming. Oranges : Good blossoming. Nectarines and peaches : Light Plums : Average to good Tomatoes : Average plantings ; both outdoor and under glass definitely backward.

—*A. R. Grainger.*

Hamilton.—Apples : Satisfactory blossoming on most varieties Gooseberries : Heavy. Lemons : Promise of good blossoming for main crop Peaches : Heavy blossoming all varieties Pears : Heavy blossom Plums : Excellent blossoming Plums (Japanese) : Heavy blossoming and setting Strawberries : Prospects of average crops. Grapes : Outdoor—Vines moving away well

—*R. G. Hamilton*

Gisborne.—Apples : Indications crop will be generally heavy Apricots, nectarines, and peaches : Average to heavy Gooseberries, plums, and walnuts : Average Lemons : Main winter crop now harvested Oranges : Indications are for heavy blossoming Pears : Heavy Strawberries : Light Tomatoes : Plants backward due to cold temperatures

—*P. Everett.*

Hastings.—Apples and pears : Heavy crops all varieties Apricots, cherries, gooseberries, raspberries, strawberries, and walnuts : Average Lemons and oranges : Moderate bloom Nectarines : Reduced heavily in some areas through frost. Peaches : Some varieties reduced by frost in parts, but heavy district yield expected. Plums : Heavy Plums (Japanese) : Some varieties reduced by frost in parts, but good district yield expected. Tomatoes : Heavy plantings

—*N. J. Adamson*

Palmerston North.—Apples and pears : Indications point to heavy setting. Apricots : Very light setting owing to late frosts Cherries and nectarines : Very light setting Gooseberries : Good average crop Peaches and plums : Patchy to light setting. Raspberries : Good promise, not many grown. Strawberries : Well forward ; promise well Tomatoes : Outside plants backward ; many killed by frost.

—*J. W. Whelan.*

Masterton.—Apples : Abundant blossoming most varieties. Apricots : Very light crops expected owing frost injury. Cherries : Good blossoming, light crop. Gooseberries : Good to heavy. Nectarines, peaches, and plums : Very light. Pears : Fair crops. Raspberries : Canes looking very well ; well furnished for time of season. Strawberries : Abundant bloom ; fruit setting well Tomatoes : Looking well under glass. Outdoor planting not commenced.

—*M. Davey*

Nelson.—Apples : Very heavy blossoming of nearly all varieties. Apricots : Moderate crop. Cherries and raspberries : Good crops anticipated. Gooseberries : Good crop. Lemons : Moderate crop anticipated. Nectarines : Good crops where no frost damage was suffered. Peaches : Moderate to good crop expected. Pears : Winter Coles patchy in places. All other varieties showed very heavy blossoming.

Indication of moderate to good crop. Plums: Moderate to good crops showing. Strawberries: Good crops anticipated. Rain badly needed. Tomatoes: Indication of good crops in glasshouses. Outdoor planting almost completed.

—*R. E. Binfield.*

Mapua.—Apples: Heavy blossoming of practically all varieties. Cox's Orange and Jonathan varieties exceptionally heavy. Sturmers patchy. Delicious in places do not appear to be setting well. Weather conditions not favourable to development. Pears: Good blossoming of all varieties. Winter Coles appear to be setting light; other varieties fair to good.

—*A. T. Douglas*

Motueka.—Apples: All varieties blossomed heavily. Good set of fruit. Apricots: Fair set. Cherries: Heavy blossoming. Gooseberries: Up to average. Nectarines: Good average crop set. Peaches: Showing well; signs of good crop. Pears: Good setting of fruit all varieties. Plums: Fairly good, especially where not damaged by frost. Raspberries: Canes coming into good growth. Strawberries: Good crops showing at present. Tomatoes: Outside plantings almost finished.

—*G. Stratford.*

Blenheim.—Apples: Present indications are for a heavy crop of all varieties, except Cox's and Dunn's, which are light. Apricots: Average to heavy. Cherries, peaches, and raspberries: Indications are for average to heavy crops. Gooseberries and strawberries: Crops generally heavy. Nectarines: Average to heavy crop set. Pears: Crop most varieties light. Plums: Crops generally average to light. Plums (Japanese): Average to light crops showing. Tomatoes: Average to heavy crop of hothouse. Outdoor damaged by frost, and a certain amount of replanting will require to be done. Walnuts: Crops light due to frost injury.

—*D. J. Hogg.*

Christchurch.—Apples: At present prospects of heavy crops of all varieties. Apricots: Medium to light. Cherries: Prospect average crop. Gooseberries: Medium to heavy. Nectarines: Medium crops except where damaged by frost. Peaches: Average crops except where damaged by frost. Pears: Prospects of heavy crops of all varieties. Plums: Medium to heavy except where damaged by frost. Plums (Japanese): Heavy crop. Raspberries and strawberries: Prospects of medium to heavy crops. Tomatoes: Under glass, average crops. Walnuts: Medium crop where not damaged by frost.

—*B. G. Goodwin.*

Dunedin.—Apples: Heavy blossoming all varieties other than Jonathan affected by frost. Apricots: Slightly below average due to frost. Cherries and gooseberries: Average. Nectarines, pears, and plums: Below average. Pears: Severely reduced by frost. Strawberries: Reduced by frost. Walnuts: Affected by frost.

—*G. H. McIndoe.*

Alexandra.—Apples: Very heavy blossoming all varieties. Apricots: Average set. Cherries, nectarines, peaches, and pears: Very heavy set. Plums: Very heavy blossoming; drop now occurring which may reduce crop very considerably. Strawberries: First flowers frosted; later crop heavy. Tomatoes: Now commencing to plant out. Walnuts: Heavy set, but some frosted.

—*W. R. L. Williams.*

SEASONAL NOTES.

THE FARM.

Importance of controlling Pasture-growth in Summer.

THE importance in respect to the nutrition of stock of preventing, as far as practicable, the development of stemminess in pastures was discussed in these notes last month. To sum up the position, "wet" stock—*i.e.*, cows, sows, and breeding-ewes—are capable of heaviest production, which normally is most economical production in respect to feed-consumption; young stock growing at the quickest rate of which they are capable normally are next in order of heavy production. The heavier the production the greater is the need for leafy pasture growth, with its greater digestibility; its greater content of mineral matter, which is required for the formation of milk and bone; and its greater content of protein, which is required for the formation of milk and flesh. The rations of wet and growing stock are in summer often below full requirements in respect to digestibility, mineral content, and protein content.

Apart from the quality of the feed, an additional advantage of maintaining pastures in a leafy condition is that to do so prolongs the period of their growth. The more pastures are allowed to become stemmy in summer the more do they appear to exhaust themselves in the development of flower-heads, and certainly they assume a condition of low production of leafage during a considerable and critical part of the season of farm-stock production—that is, during late summer and early autumn. On the other hand, pastures in which flower-head development has been minimized have a correspondingly greater tendency to continue the production of leafy herbage right through the season.

Still another advantage of avoiding stemmy growth in pastures as much as possible is the fact that swards which are allowed to become tall tend to become undesirably open and certain valuable species may be weakened by taller-growing competitive species in the sward.

Important means of maintaining leafiness in pastures during summer were set down in these notes last month. Further to last month's notes, for the purpose of stimulating fresh leafy growth in the latter part of the summer, at times it may be advantageous to top-dress some of the pastures of a farm with superphosphate in early summer. Observation in the field points to the conclusion that such top-dressing is most effective in districts in which a good deal of rain falls in December and January. As such rainfall decreases, top-dressing declines in effectiveness as a means of obtaining additional late summer leafy feed until a point is reached when its influence upon the summer leafiness of pastures is negligible. Areas from which hay or silage has been saved often profitably may be top-dressed in December with superphosphate, which tends to increase the production of leafy feed later in the summer, when such feed frequently is in scant supply and therefore particularly valuable. It has been found that later on the influence of phosphates applied about mid-summer approximates that of identical fertilizer applied in the autumn.

The facts about the summer control of the growth of pastures given herein and in the last month's notes have long been known; the economic value of their application has been demonstrated strikingly by certain progressive grass-farmers. But, despite the fact that their pastures could be kept in a much more leafy condition during summer without any great outlay or effort, a great many farmers do nothing year after year to improve their inefficient summer control of the growth of their pastures.

Lucerne Culture.

As a rule, in many districts best results are obtained by sowing lucerne in the latter part of November or in December. Sometimes in favourable seasons or other favourable conditions, such as location, good results are obtained by earlier sowing. The basic fact that should be reflected in practice is that the ultimate success obtained with lucerne depends to a considerable extent upon the rapidity of its growth in its infancy, which in its turn, when supplies of moisture and plant-food are adequate, is determined by the warmth of the soil. Hence, as a rule, there is no justification for taking the risk of slow initial growth due to early sowing, unless it is expected that dry conditions will be experienced in late summer before a crop sown late in November or in December has become safely established. Special circumstances may justify late summer or autumn sowing, which sometimes is quite successful; but in the milder districts in which certain of the plants which commonly invade lucerne make some growth, even if but little, practically through the winter, late summer or autumn sowing of lucerne usually is unsuccessful, except when much tedious weeding is carried out to prevent the smothering by the invading plants of the lucerne seedlings at a standstill in their growth during the winter.

A fine, firm seed bed contributes to rapid, vigorous establishment of seedlings and is essential for best results. Good results follow sowing 12 lb. to 18 lb. an acre of seed through every coulter of a grain-drill; the poorer the preparation of the seed-bed, the more seed is required. Broadcasting of the seed and covering it by light harrowing is an alternative practice which as a rule gives results not quite as good as drilling. Generally, lime may be applied profitably before the final cultivation preceding seed-sowing, and the application of phosphates at or about the time of seed-sowing is, as a rule, distinctly beneficial to net returns. Inoculation, the importance of which is noted subsequently herein, may not take place if superphosphate comes in contact with the seed and nullifies inoculating treatment—this undesirable effect may, however, be avoided by not sowing seed and superphosphate mixed together. When it is desired to sow seed and fertilizer mixed together this may be done safely by using an insoluble fertilizer such as basic slag or by sowing the seed with carbonate of lime and superphosphate mixed in equal proportions for about a week before bringing the seed in contact with the mixture.

Lucerne, in common with other legumes such as peas and clovers, works in partnership with certain soil bacteria. The legume helps the bacteria by furnishing them with a home and food, but the bacteria are so helpful to the legume by supplying it with nitrogen, which they get from the air that they are essential for full thrifty development of the legume. Different legumes work in partnership with different strains of bacteria, and there is no way which can be used by farmers before growing the crop of discovering whether the soil contains sufficient numbers of the organism suitable for a specific crop. Although the organism needed for full success with lucerne is present in some soils in adequate supply, in other soils it is not so, and hence the safest course is to supply the organism artificially. This is called soil inoculation. Field experience shows that in various districts throughout New Zealand poor past results with lucerne have been due primarily to the absence of the particular organisms with which lucerne works in partnership. Supplies of the bacteria are called cultures and may be bought from the Department of Agriculture at a cost of approximately 1s. for the treatment of the seed sufficient for an acre.

Often lucerne should be mown in November or December. If the weather is unfavourable to the production of good hay the lucerne may be used for ensilage. Should the amount of lucerne available be too small to allow of ensilage without undue waste, then it may be saved, together with green material from the pastures or from such a crop as green oats. The making of good lucerne hay calls for care designed to avoid the loss of leaves, which readily occurs if handling is faulty. The mown material should not be left in the swathe to dry sufficiently to allow of direct carting to the haystack—this would result in the leaves, which are much more nutritious than the stalks, becoming dry and brittle and in many of them being lost during carting in. To avoid such serious loss lucerne hay should be cocked. Lucerne hay fairly often is stacked before it is dry enough—this is probably so because the stems do not become dry enough as quickly as do the leaves.

Lucerne should be mown when new shoots are just starting from the crowns or bases of a considerable number of the plants. As a rule, when new shoots have so developed about a quarter of the plants are in the early-flowering stage, but as this is not always true, reliable guidance about the time to mow is not provided by observation of the flower-development.

General Cropping.

Good farmers in most districts become very busy with special cropping work in November and December.

Of the crops generally sown at this season the swede is of outstanding importance. Partly as a means of reducing the ravages of diseases such as club-root and dry-rot, swedes are almost always sown on land ploughed out of grass, and records relative to farmers' field competitions definitely point to the advantages of this practice. Over wide areas successful results may be expected from sowing swedes in December at the rate of 10 oz. to 14 oz. an acre. Sowing through every second coulter of an ordinary grain-drill is probably most popular, but sowing through every coulter has often given good results, and, especially in the South Island, sowing in ridges followed by intertillage also consistently has given good results. The popularity of varieties of swedes differs greatly from one district to another; in the southern portion of the North Island Superlative, Majestic, and Grandmaster have proved popular, while in Southland, Elephant and Masterpiece seem to have been favoured considerably. It now is common practice in districts of good rainfall to use 2 cwt. to 3 cwt. an acre of fertilizer of which phosphate is the dominant constituent, while in districts of such low rainfall, as is normal in Canterbury, superphosphate at the rate of about 1 cwt. an acre mixed with an equal amount of carbonate of lime is favoured.

The sowing of soft turnips also is often carried out successfully during December, 12 oz. to 14 oz. an acre of seed in rows 7 in. apart being used frequently as also is a seeding of 8 oz. to 14 oz. an acre in rows 14 in. apart, while in the case of crops to be thinned about 9 oz. to 14 oz. of seed are sown in drills 26 in. apart, and when soft turnips are broadcasted about 2 lb. of seed an acre are used.

Rightly chou moellier maintains its popularity, which in some districts seems to be increasing, this possibly because of its reliability and its relatively low labour requirement. It is highly desirable to bear in mind that success with chou moellier calls for high fertility such as is required for success with cabbages. If suitable fertility is not present naturally it may be provided by the use of farm manure, such as old stack bottoms and animal excreta, together with artificial fertilizer in which superphosphate may well be prominent. Sowings in December provide winter feeding. A suitable sowing is 1½ lb. to 2 lb. an acre broadcast or ½ lb. to ¾ lb. an acre in drills 2 ft. to 2½ ft. apart.

Much of the considerable area devoted to rape in New Zealand is sown in Canterbury or in districts with climatic conditions which approximate those of Canterbury. The fullest success with rape calls for a well-prepared, firm, fertile, moist seed-bed. As a rule ten weeks to twelve weeks on light land and twelve weeks to fourteen weeks on heavy land elapse between the date of sowing and the date the crop reaches the best stage for use in the fattening of lambs—called the "ripening" stage. Sowing usually is carried out from late in October on light land to January on heavy land, on which sowing prior to early November is not usual because rape responds well to warmth at the outset. Rape usually is sown at the rate of 2 lb. to 3 lb. an acre, being drilled in rows 7 in. or 14 in. apart. On heavy land the 14 in. rows are usually preferred, as the wider rows minimize the wastage that sometimes occurs in dense crops. Good results may be expected from the use of 2 cwt. to 3 cwt. an acre of a mixture in equal parts of superphosphate and lime drilled in with the seed, while reverted superphosphate at the rate of 2 cwt. to 3 cwt. an acre is also a suitable fertilizer for rape. While the area of rape required to fatten a given number of lambs varies greatly mainly because of substantial variations in the yields of different crops and in the drafts of lambs to be fattened, the following generalizations are in accord with field experience: A good crop of rape fattens twenty-five to thirty lambs an acre, an average crop fifteen to twenty-five lambs, and a somewhat poor crop eight to fifteen lambs an acre.

In the sowing of swedes, turnip, rape, and chou moellier special care should be taken to avoid the serious injury to the seeds which results by bringing them in contact even for a short time with readily soluble manures such as superphosphate, sulphate of ammonia, and potash salts. One way of avoiding the injury caused by superphosphate is to mix one part, by weight, of suitable ground limestone (carbonate of lime) with one or two parts of superphosphate. The mixture should not be bagged as soon as it is made as it usually sets hard to some extent; it may be bagged after it has been made two or three days, when it may be pulverized easily in the heap. Unfortunately, some lines of ground limestone are not effective for the purpose just mentioned, and a farmer uncertain about the efficiency of any particular limestone for this purpose may obtain guidance from the local officer of the Fields Division.

In some districts the use of borax for the control of brown heart in swedes is advisable, but in other districts it is considered unnecessary, and evidence points to the indiscriminate use of borax being at times wasteful.

There seems to be some confusion as to the purpose of using borax in growing swedes, it being thought in some instances that the use of borax would assist in the control of such diseases as dry-rot and club-root. Actually the use of borax is recommended solely for the control of the specific disorder brown-heart, and where brown-heart has not been in evidence the use of borax is not known to give any benefit. Borax, if not used in a suitable manner, is known readily to lower the germination of swede-seeds to a serious extent. Full particulars about the safe and profitable use of borax under varying conditions may be obtained from the Department of Agriculture.

Spraying for the control of late blight of potatoes (*Phytophthora infestans*) may be advisable. For this purpose Bordeaux mixture has proved effective provided a thorough covering is maintained. This may necessitate frequent spraying, but in dry seasons or in dry districts it has been found that spraying is not necessary. Generally spraying may be expected to give good results only when it serves as a preventive instead of as a cure. While spraying may be of considerable value in checking the spread of blight which has gained a footing, its greatest service results from preventing the footing being obtained. If suitable procedure is not followed in either preparing or applying the spray the result is likely to be either damage to the crop or failure to control the blight. Detailed guidance about spraying may be obtained from local officers of the Fields Division.

Maize and millet to provide green feed usually may be sown with success in November or December Good results have been obtained by sowing maize broadcast at the rate of 75 lb an acre (12 lb to 15 lb. an acre in rows 3 ft. apart are sown for cob maize) and covering the seed by a very shallow ploughing Sowing Japanese millet at the rate of 15 lb. to 20 lb. of seed an acre has consistently given good results. Usually both of these crops profitably may receive 1 cwt to 2 cwt. an acre of superphosphate, and unless the soil is distinctly fertile it usually is profitable to include also some nitrogenous matter in the manurial dressing.

In its advisory work the United States Department of Agriculture emphasizes that "good seed is cheap at any cost, poor seed is time and money lost," a pithy statement of facts which well might be given more attention by New Zealand farmers than it seems to receive. According to the Seed Analyst, the work of the New Zealand Seed-testing Station shows that the standard of the seed trade in New Zealand is, on the whole, a high one. While this is a matter for congratulation, against it is to be set the fact that very poor lines of seed are at times sold to farmers who do not take the precautions needed to ensure a supply of truly satisfactory seed; in fact, these poor lines of seed are at times so poor that it is quite impossible to get any but grossly disappointing and unprofitable results from their use. Assuming that the appropriate strain or variety of seeds is being purchased, the real value of the seeds depends basically upon (1) the extent to which they are true to name, (2) the percentage of the true-to-name seeds which are capable of germination, and (3) the vigour of their germination. The farmer must depend to some extent upon the integrity of the seed trade in respect to the seeds being true to name, but he has some important protection in that official information is obtainable as to the impurities and inert matter in seeds, and impurities may include most undesirable weeds. The farmer is able to obtain from official sources all necessary accurate information about the germination of seeds. A point to which it seems necessary yet to direct attention, although it often has been emphasized in the past, is that neither the appearance nor the bushel-weight of seeds is a reliable index of their real value and, indeed, in purchasing seed one may go far astray by using either appearance or bushel-weight, or both of these, as a measure of value.

Intertillage and Thinning.

Insufficient tillage is one of the most common causes of crops being limited in yield. The value of the cultivation which gives a good seed-bed is generally known even though at times, judging from farm practice, this knowledge seems to be overlooked. But the value of suitable cultivation after the sowing of the seed, when such cultivation is practicable, is not so generally realized; and this type of cultivation is of special importance at this season. Apart altogether from weed-control, which is of basic importance, a growing crop in badly cultivated ground is not likely to obtain the fullest possible benefit from money spent on good seeds and the liberal use of suitable fertilizers. Further, if a dry spell of weather occurs such a crop is likely to suffer in yield because of the inadequate supply of moisture in the soil—suitable surface cultivation assists in conserving soil-moisture. Hence, intertillage of growing crops sown in rows wide enough apart to allow of it is in general highly desirable even though weeds are not a menace to the crop. This is particularly true of the drier districts.

Often in December thinning, as well as intertillage, of crops sown in October or November is advisable. The task of thinning usually may be lessened by prior hoeing along the rows. Thinning is most valuable if done as soon as the seedlings are large enough to allow of easy handling. The weeding which is carried out during such early thinning brings about the destruction of the weed-seedlings at the stage when they are most easily destroyed. In thinning mangels the soil should be drawn away from the seedlings rather than hoed up to them.

—*R. P. Connell, Land Utilization Officer.*

THE ORCHARD.

Pest and Disease-control.

REFERENCE to the spray programme issued in the September number of the *Journal* will act as a guide to growers with their spraying operations during the next month or so. In the spray schedule given on page 179 of the September *Journal*, under (3) " Petal-fall period," a transcription error has occurred—the lime-sulphur dilution should read 1–150, not 1–500 as printed.

Fruit-trees are now in full leaf, and therefore it will be more difficult to obtain a complete coverage with the spray. A little extra time spent on each tree to ensure that every branch, twig, and leaf has been coated with spray will be time well spent. Good pressure is very necessary, especially if the trees are at all dense. The system of pruning with the reduced number of leaders that is now being practised in many orchards materially assists spraying operations, as it enables all parts of the tree to be reached with comparative ease. From now on warm, dry weather conditions may be expected, and some growers are apt to take undue advantage of such conditions by lengthening the period between sprays, insecticidal or fungicidal, beyond the time for which they are effective. It must be remembered that to get the best results from spraying a protective covering should be on fruit and foliage all the time; consequently to extend the period between sprays over the recommended fourteen to eighteen days is running an undue risk. Insect pests are on the increase at this period of the year, and precautions taken now will prevent them from establishing themselves to the detriment of fruit and foliage later in the season. Many growers are inclined to leave the first application of lead arsenate for the control of codling-moth until the fruit is well advanced. It should be remembered that the " calyx " spray is of importance in the control of this pest, and neglect in this respect cannot be remedied. This early spray of lead arsenate will also control bronze beetle. As previously recommended, lime-sulphur solution may now be reduced in strength to 0·083 per cent. (1–180), especially where colloidal sulphur at a dilution of 2 lb. per 100 gallons of spray is used in combination. Where the lime-sulphur and lead arsenate are used in combination it is advisable to add to the mixture 2 lb. of hydrated lime to prevent russet and scorch. Regular sprayings with lime-sulphur at this time of the year should keep red-mite in check until January, when it may be necessary to apply summer oil at strength 1–100 for its control.

Thinning.

Reports from all parts of the Dominion indicate that, with the majority of varieties of apples, the setting of fruit has been good; and, although a customary natural dropping may be looked forward to, it appears as though the crops are going to be particularly heavy. Growers are therefore advised to spend more time on thinning fruit than has been the usual custom. There is no doubt that this practice is not given the attention it should receive, with the result that many growers harvest a large crop of small fruit. It should be remembered that whilst it costs more to prepare a crop of small fruit for market, the price obtained for such fruit is almost always below the average. Very seldom does a grower over-thin his fruit crop—usually it is the reverse It is not the quantity of fruit that is taken off the tree when thinning that counts, but the balance left on the tree after adequate thinning has taken place The ground round the tree may be carpeted with small fruit, and still the tree have too much left on to give the best results. Not only will the proper thinning of fruit produce improved quality on the remainder, but at future sprayings more efficient coverage of the fruit to protect it from codling-moth and leaf-roller caterpillar will be obtained. The resultant crop will also be more uniform in size, whilst the grade will be raised considerably The elimination of diseased, malformed, and clustering fruit will reduce the percentage of waste to be handled at harvesting time, and also help to promote more growth and bud development on the tree for the production of fruit

At least two thinnings should be given to the majority of varieties, and in some cases it is of advantage to give three, usually commencing soon after the natural drop for each variety has taken place During the first operation all clusters should be reduced to two or three fruits at the most, always taking out the centre fruit Care should be taken not to injure the remaining fruits or spur. The operation can readily be done by pressure of the fruit to be taken off between the thumb and finger, with little or no damage to the spur. If this method is not favoured, thinning-shears can be used, but care must be taken not to pierce the remaining fruits with the points of the shears At the second thinning all diseased or malformed fruits should be eliminated, and any further spacing necessary should be attended to. The object should be to see that every individual fruit has sufficient room to develop and mature naturally. If this is done fruit of good colour, shape, and size will be the result.

Grafts.

Grafting for the season will have passed long before these notes appear, and the scions should now be starting well into growth It is well to examine these grafts periodically and see that no strangulation is taking place by the bindings (where used) Where such is the case, the binding should be cut on the opposite side of the stock from the graft to allow for the free growth of the scion, which is usually heavy at this time of the year. All growths coming from the stock should be rubbed off, except in cases where the renovation of trees by the "porcupine" system of grafting has been done. It is sometimes necessary to leave a growth here and there, where a graft has not taken, to provide good wood for budding-purposes later in the season; otherwise all shoots should be suppressed.

General.

Growers are advised to keep a sharp look-out for signs of fireblight. Blossom-infection not detected will spread to the twigs and laterals, when the foliage on affected portions will droop, turn brown, and hang on the tree. All such infections should be cut out and destroyed as soon as possible.

Cultivation should be continued throughout the month by frequent stirrings of the soil by harrow or cultivator, especially after rain. This will not only reduce the soil to that fine tilth so necessary, but will help to conserve moisture for the drier periods later in the season.

As harvesting time is approaching, casemaking should be undertaken at every opportunity. Packing-sheds and grading-machines, &c., should also receive attention. Usually during the off-season the packing-shed is the housing-place for almost every spare part on the farm, whilst in some cases rotting fruit is allowed to remain until the following season. Reports on the fungal rotting of fruit on the overseas markets point to unhygienic conditions prevailing in and around the packing-shed; therefore it is imperative that every grower should take the necessary precautions to see that the packing-shed and its surroundings are kept clean and in an hygienic condition to avoid further losses in the future. This can only be done by a thorough cleaning of the packing-shed, grading-machine, lidding-press, benches, &c., getting rid of any old disease-ridden fruit-cases, and by thoroughly spraying the whole with a solution of bluestone (1 lb. per 400 gallons water), (metals should be protected from this solution), or with formalin solution (1 part by volume of commercial formalin to 50 parts water).

—*George Stratford, Orchard Instructor, Motueka.*

Citrus Culture.

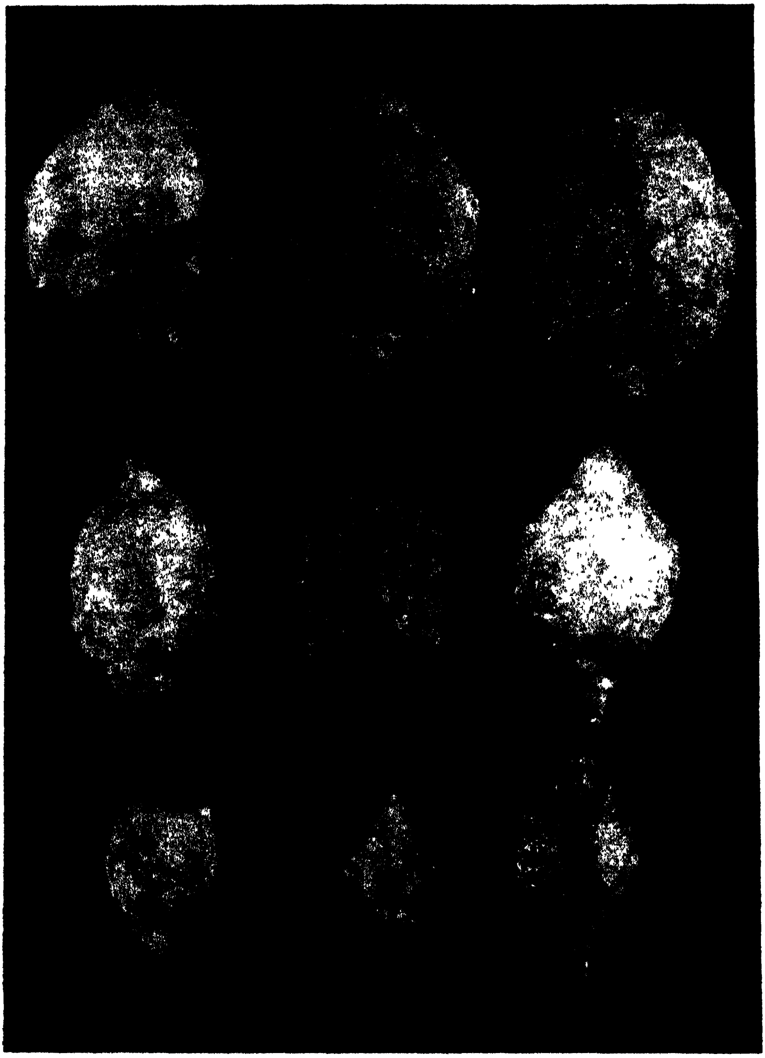
Most citrus trees will be in bloom when these notes appear, this, being the commencement of the next main crop, is also the commencement of the period wherein the trees require expert cultural attention. Neglect to cultivate at any period during the development of the fruit may result in considerable loss.

Disease-control.—As mentioned in these notes for the previous month, this is the most important period of the year for the control of verrucosis, and where there is danger of infection the trees should receive their first preventive spray when the earliest fruits of the main crop are setting. Bordeaux mixture at a strength of 3–4–50 is recommended for this purpose.

Bark-blotch is a disease that kills the bark and is usually found attacking mature trees either on the trunk or in the main forks of the tree. The presence of the disease is indicated by a slight discoloration of the affected area, and not infrequently is associated with an exudation of gum. The disease is particularly active at this period of the year, consequently all trees should now be examined carefully for signs of infection. Control-measures consist of cutting out all of the dead bark—cutting well back into the healthy bark—and swabbing the wound with bordeaux paste. When dry the area should be painted with a wound-dressing of the bitumen-emulsion type. Before commencing to operate on a diseased tree a ground-sheet should be spread around the tree to catch all of the diseased tissue removed. This infected material should be burned and not left in the orchard to become a source of further infection.

Insect Pests.—The examination of trees for the presence of wood-borers can be made at the same time as the trees are inspected for bark-blotch. The treatment for this pest appeared in these notes for December last.

Scale insects are probably the most persistent of the insect pests attacking citrus. The two species most prevalent are the black scale (*Saissetia oleae*) and the red scale (*Chrysomphalus aurantii*). Hot, dry weather heralds the period of greatest activity of citrus-scale insects. Young scales of the former species are commonly found in large numbers as early in the season as November. The presence of these scales is usually indicated by a rapid spread of the sooty-mould fungus on the foliage. Spraying with a summer oil 1–60 should be resorted to as soon as the insects become troublesome. The addition of 1 per cent. summer oil to the Bordeaux spray to be applied for verrucosis-control will kill many of the young scales. Red scale is more difficult to control, and in dry seasons at least four applications of summer oil at a dilution of 1–33 may be necessary to effect a satisfactory control. The first application should be made during December–January if young scales are hatching freely, the second in late February, the third towards the end of March, and the fourth about mid-April.



LEMON FRUITS AFFECTED WITH CITRUS-VERRUCOSIS.

Citrus thrips are usually prevalent during the main blossoming period, after which they have been observed to almost completely disappear from the trees. Late in January or in February they reappear on the fruit and foliage and rapidly multiply as the season advances. Spraying experiments conducted over two seasons by this Department with various specifics indicated that sprays applied during or near the blossoming period had little or no effect on either the amount of thrip injury to the fruit or on the setting of the crop. However, good control of thrips was secured later in the season. The control-measures recommended will be supplied in my subsequent notes.

Mulching.—The need for supplying organic matter to the soil around citrus trees is realized more now than at any previous period. No matter what quantities of fertilizers are applied, the maximum results cannot be expected without an ample supply of humus in the soil. In orchards of mature trees where most of the land is covered by the spread of the branches it is, in some cases, not possible to grow a satisfactory cover crop. Where such conditions obtain an area adjacent to the orchard should be set aside for the purpose of growing organic matter such as lucerne or clover. The crop can be cut several times during the season and applied as a mulch under the spread of the trees. This material very soon decays and mingles with the soil, and at the same time will greatly conserve the soil moisture during the summer and autumn months. Several citrus growers have adopted this practice in recent years with encouraging results.

—*P. Everett, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

Feeding.

THE primary purpose of feeding is to sustain life, build up waste in tissue, and maintain natural conditions, and, secondly, that certain materials may be transformed into more suitable forms of food for human consumption in the shape of eggs and poultry-meat.

The most commonly used and satisfactory foods for poultry in this country are obtained from grains, such as wheat, maize, barley, and oats; mashes made up of pollard, bran, wheat-meal, oat-pollard, barley-meal, or maize-meal; animal food in the form of meats, meat-meal, milk, or fish-meal; mineral matter in the form of oyster-shell grit, also metal grit and succulent green food. The last, but by no means the least, essential is a good, clean, fresh, and constant supply of water.

All foods are composed of certain substances, which have been grouped by chemists into the six following classes: Water, carbohydrates, protein, fat, ash, and vitamins.

When the food is digested and assimilated each substance performs a particular function in nutrition, promoting growth or egg-production. It will thus be seen that the success to be obtained from the feeding of any particular food or ration will depend, to a large extent, upon the correct balance of the various substances contained therein.

While the feeding of a well-balanced ration will always give the best results where a flock of birds is concerned, there are at times factors beyond one's control, such as climate, soil, and individual temperament when foodstuffs do not always have the same value or the same physical effect upon all systems. The poultry-farmer is advised, however, to give some time to a study of this important branch of his work, and he would be wise to have on hand a table giving the analyses of the various available foods, as such will often be useful and assist in a more intelligent use of certain foodstuffs. Science has done, and is still doing, great work for the poultry industry, and a perusal of reports from world research workers makes very valuable and interesting reading and is time well spent.

While it is recommended that the poultry-farmer should know something of the composition of the most popular foodstuffs, it is not suggested that the beginner should first spend time and perhaps money in trying to make up or experiment with new mixtures. The novice should really first learn just *how* to feed and manage his birds, and when it comes to exactly what to feed, his best plan would be to follow very closely the methods adopted by some successful poultry-keeper, for the successful man does, as the result of practical experience, feed his birds in a scientific way, although perhaps theoretically he may not know much about how to tell whether a certain ration is scientifically balanced or not

Process of Digestion.

The process of digestion in poultry differs from that of animals which chew their food. Briefly, science describes the process as follows: Fowls swallow their food and it is passed into the crop without mastication; here it absorbs moisture, which softens it and aids in its passage to the gizzard The crop is really a store-house for food, and as it is required it is passed into the esophagus or stomach Here it is mixed with secretion similar to saliva, which acts upon the carbohydrates, converting them into sugars The food is then passed into the lower stomach, when another juice—the gastric—is poured upon it, thus reacting upon the proteins After leaving the stomach the food is passed to the gizzard, where, by the aid of powerful muscles and sharp grit, it is ground into pulp From the gizzard the food is passed into the small intestines, where two more secretions—the bile and the pancreatic juice—are mixed with it. These juices emulsify the fats; they also act upon the carbohydrates and proteins, and continue the work started by the saliva and gastric juice

The digestible nutrients are taken from the food and converted into blood This process goes on as follows: The inner walls of the intestines are covered with very small projections, which absorb the digested material from the contents of the intestines. There are two kinds of small tubes within these projections One kind connects with the waste-gathering system and conducts certain material to a large tube along the backbone, the contents of which are eventually taken up by the blood

The other kind of tubes belong to the blood-circulatory system, they conduct other digested material to the liver, where it is purified before it is used to build up the body. The indigestible part of the food passes into the rectum, and out of the body.

Breeding and Environment.

In order that this transformation of food may take place in a profitable way it is, of course, essential that the birds possess that inherited constitution in order that all organs of the body can carry out their various functions in a constant and efficient manner. When it comes to great egg-production it must be remembered that birds not only need great stamina so that the system will stand up to the drain of heavy production, but they must be endowed with that inherited faculty which enables them to produce a large number of eggs, for the very best of feeding will not transform a naturally poor layer into a very prolific producer.

These are, of course, matters of selection and breeding, but they must be given careful and constant attention before the most profitable returns can be expected from any particular system of feeding.

Environment.

As environment includes all the external circumstances of an organism and the great function of environment is to sustain, not to modify, it should also be remembered that proper care and management are vital essentials to success.

It is not unusual to find a successful man feeding a certain ration, while his neighbour, who feeds the same class of ration to a similar strain of birds, fails to make a success of the business. This is why many experienced poultry-keepers will argue that good environment is of equal importance as good breeding. Even the very best of birds must be kept in good health, and judgment must be exercised and care taken to see that the quality, quantity, and regularity of the food-supply is correct, and also that sufficient exercise and good housing-conditions are available. These points have been mentioned because the novice, if not getting satisfactory results, often varies his method of feeding, when the fault lies in the direction of some condition existing in the environment.

What to feed.

There are, of course, many different mixtures and systems which have been used successfully. The following is one that is commonly used: A mash made up of two measures of pollard, one of bran, and from 5 per cent. to 10 per cent. of meat-meal (a little extra pollard is added if quality is poor), the lot mixed to a crumbly state with water, skim-milk, or soup. Up to 10 per cent. of meat-meal is fed from about April to August, when it is gradually reduced until by September not more than 5 per cent. is given. The amount of meat-meal may again be gradually increased about November.

Where milk or soup is used to mix the mash, less meat-meal should be used.

This mixture should be fed in troughs and as much given as the birds will clean up in half an hour. It is usual to feed the mash first thing in the morning and grain at night, but it really does not matter whether the mash is fed night or morning. However, it is better not to be always altering the times of feeding. A good feed of succulent green food is given each day; some feed this about noon, while others prefer to give the green food after the last feed in the evening.

Wheat is the most popular grain, and where available a grain mixture that has given good results is made up of three measures of wheat and one each of barley and broken maize. The grain should be fed in deep litter in order to encourage exercise, and as much given as the birds will clean up in about half an hour.

A supply of oyster-shell and metal grit should be always within reach of the birds. Great care should be taken to see that the water-supply is constant, fresh, and clean.

Further feeding notes will appear next month.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Artificial Increase.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer, if two or more are united or if each one is reinforced by the addition of bees and brood from strong colonies, they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming and saves a great deal of trouble where increase is desired

Supering.

In most districts November is early enough for the employment of supers, though much depends on weather-conditions If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

Care of Bee-yard.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—*E. A. Earp, Senior Apiarist.*

HORTICULTURE.

Vegetable Crops.

ABOUT the beginning of the month of December, when a variety of vegetables is available, it is advisable to stop cutting asparagus and allow the plants to mature their growth. In doing this they should be assisted by applying a generous dressing of manures and fertilizers. The crop has probably had a few applications of nitrates during the cutting period and now requires a substantial and more varied application. In deciding on its composition it is well to remember that a generous supply of humus in the soil should be maintained and the crop is partial to a good supply of potash, but phosphates must not be altogether omitted. The dressing is applied between the rows and cultivated in. For somewhat similar reasons the rhubarb crop should receive the same attention.

As the early crops of peas, potatoes, salads, &c., are cleared the ground is prepared for such winter crops as celery, leeks, savoys, red cabbage, Brussels sprouts, cauliflower, broccoli, &c. All of these crops are partial to lime, and, in most instances, it is a suitable occasion to apply a generous dressing. If ground raw lime is used (carbonate of lime) it is important that it should be finely ground. Burnt lime in powdered form (hydrated lime) has had the carbon driven off in the burning process; it is caustic, essentially stronger, and quicker in its action. It should be used only on the heavier land. As liming is often neglected, it should be remembered that not only is it required by certain crops, but on heavy land especially it is necessary in order to maintain the soil in a mechanically friable condition while on land inclined to be acid, as is so often the case, it is required to enable such fertilizers as superphosphate and sulphate of ammonia to function effectively. As it leaches out there is no need for anxiety regarding the behaviour of crops requiring an acid soil, such as potatoes, tomatoes, strawberries, &c., that may be planted later; in fact, such crops do rather better on land which is only slightly acid. For this class of cropping lime is sometimes applied annually in moderate quantities such as half a ton to the acre, equal to about 3 oz. to 4 oz. to the square yard, or at longer intervals in quantities up to 2 tons per acre.

A moist soil, rich in humus, and well drained is required to produce a good celery crop. On land of this description such varieties as Golden Self-blanching may be planted 9 in. apart and 12 in. between rows. A wider space should be allowed after every sixth row to give access for spraying, weeding, &c. In preparation for planting a good dressing of manure, such as fowl-manure and, if the land is light, an equal part of cow-manure, is ploughed under. While cleaning the land an application of superphosphate and sulphate of potash is worked in. Where a liberal preparation has been made for the previous crop this treatment may be modified accordingly. Where a larger variety, such as Solid White, is to be grown a good deep drill may be struck at intervals of 3 ft., the fertilizers worked in, and the plants set out in the drills at intervals of 8 in. or 9 in. In dry localities and soils it is necessary to plant out in prepared trenches to economize and facilitate the application of irrigation water. This crop must be kept growing steadily, and to do this it must not be allowed to lack moisture, irrigation by flooding or sprinklers is frequently necessary to supply its requirements in this respect. To control the attack of leaf-spot disease (*Septoria Apii*) spraying with Bordeaux 3-4-50 is usually necessary at intervals of about three weeks from the seedling stage onwards. Washing-soda may be used in the place of lime (it is then known as a Burgundy mixture), and it is indeed preferable in the later stages of growth, as there is less residue left on the stalks. In any case, care must be taken to see that a thoroughly clean product is placed on the market.

During the month of December a late crop of peas may be sown, also shorthorn carrots, globe beet, lettuce, and, in warm districts, dwarf beans.

An important operation at this season is to mow hedge bottoms and headlands where weeds and rough grass are growing in the vicinity of these crops. If this is done before seeds are formed it will do much to control the spread of weeds, and the material will be useful for mulching, or, if stacked green in the compost heap, humus for application to the land later.

Small and Sundry Fruits.

Planting distances for the tomato crop under glass vary widely in practice. There is often a tendency to crowd the plants with a view to getting the greatest possible weight of fruit from the limited area. At the Cheshunt Research Station last season this matter was the subject of an interesting test, which is to be repeated. Plots were planted 18 in. and 27 in. between rows alternately, and 14 in. between plants. Others with similar spaced rows and 18 in. between plants. Others, again, 27 in. between all rows and 14 in. between plants. And yet others 27 in. between rows and 18 in. between plants. The results indicate that the yield per acre was practically the same with each of the different methods of planting. Also there was little to choose between the different methods as regards the quality of the fruit, which however, tended to be slightly larger where the spacing was wide. Although it was not stated, there would hardly be any doubt that the cost of production would be lower where the spacing was wide and the management would be greatly facilitated. A very fine crop was seen here recently in a heated house spaced 24 in. and 30 in. alternately between rows and about 14 in. between plants. Experience appears to indicate rather strongly that most growers would be wise to increase planting distances, especially where early crops are grown in heated houses, or without heat in the warmer and humid localities. The unseasonable frosts experienced in mid-October in many districts were a considerable check to the early outdoor crop, and the crop under glass should realize good prices for a longer season as a consequence.

Where fine weather and high temperatures are experienced for a long period during the summer it is often an advantage to apply a light shade on crops of tomatoes under glass. This may be done by mixing whiting and linseed oil and applying it to the roof of the house outside in the form of a light spray. With good ventilation and a mulch the plants will then often keep their condition better. In warm districts where a late crop of tomatoes is planted outside about the middle of December the plants will stand up to winter conditions better if nitrogenous manures are used sparingly and the ground is firm when planting out.

The gooseberry crop is in many instances harvested in a green condition, but it should be more generally realized this fruit makes an excellent conserve if gathered as soon as it commences to turn colour and before the skins become tough.

Egg-plants and peppers should now be planted out in the warmer districts. There are signs of an increasing appreciation for these fruits.

The Homestead Garden.

Half-hardy flowering annuals are now available for planting out and are useful for brightening up any desired position in the garden and affording variety and a new interest. In wind-swept, bone-dry, or shaded situations there are plants of this class which will thrive and bloom abundantly in any position if carefully selected. Planting is best done when a period of dull or showery weather may be expected, and if this operation is preceded by working into the soil a little bone-dust and superphosphate, and followed up (if a dry period should be experienced) by occasional irrigation until the plants are established, little further attention will be required.

Thinning, stopping, staking, and tying young growth and buds of plants in the herbaceous border occupies considerable time now if a good display is to be obtained. On that account it is wise to keep this area well within the limits of the labour available.

Where narcissus and other spring-flowering bulbs are to be lifted it is usually best done now as soon as the foliage really commences to die off. The bulbs should not be unnecessarily exposed to the sun, but spread thinly in a well-ventilated shed or other position free from draughts and strong light When dry they are cleaned, graded for size, and stored in a dry, cool shed until wanted for planting. Some kinds, chiefly from Africa and the Continent of Asia Minor, are rather exceptions to this rule in so much that they can hardly be sun-roasted too much, as in their native state they are accustomed to hot, dry summers. *Iris tingitana*, a native of Tangiers, is a handsome winter-flowering, bulbous iris which in some places refuses to bloom without a summer treatment of this kind. Where it is not desired to lift bulbs of this class the necessary conditions for flowering them satisfactorily may sometimes be provided by covering the plants with a glass frame as soon as they die down, and so providing the dry, hot conditions required during the resting period.

When the bedding plants in the frames are cleared consideration may be given to sowing seeds of perennial herbaceous plants such as anemone, pansy, viola, primrose, polyanthus, &c.; also biennials, such as stocks and wallflowers; and during the months of February and March hardy annuals, including sweet peas, for flowering during winter and spring.

During dry periods in summer late-planted shrubs and those, such as rhododendrons, which like moisture, should be watered well and given a light mulch of half-decayed stable manure or lawn clippings, &c. Young climbing plants set at the base of a warm wall will be specially grateful for such attentions.

As garden operations have to be planned for at least twelve months ahead special consideration should be given now to the requirements of the planting season, whether it be for timber or shelter, fruit or flowers —the kind, variety and number of each required should be decided and the position they are to occupy. Also any removals of young trees or shrubs into a different position in the garden that may be required should now be decided on. Notes of this kind made during the summer and the local nurseries searched for suitable stock, will enable the preparation of the land to be undertaken in due season and planting done to best advantage.

—*Wm. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: OCTOBER, 1937.

Dominion Meteorological Office.

NOTES FOR OCTOBER

IN the Dominion as a whole October was a very dry month with a good deal of wind, which came mainly from a southerly quarter. The atmosphere was generally dry and cool and frosts were unusually numerous, especially in the South Island. Though there is, in most districts, as yet no acute shortage of feed, the growth of pastures and vegetation generally has been poor. The rains from the 23rd onward relieved conditions considerably in the North Island, but the subsequent fine weather with drying winds has, to a considerable extent, nullified their effect Grass is tending to flower early, and while still short. Stock are, on the whole, in very good condition, especially lambs. Conditions are very favourable also for shearing. In portions of Marlborough, however, there is serious shortage of feed, and both stock and crops are doing poorly. General steady, soaking, and mild rains are needed soon or the effects of the dry weather are likely to become serious.

Rainfall.—Except for some good rains on the west coast of the South Island in the early part, the first three weeks of the month were extremely dry, many areas in the North Island having no rain at all. Between the 23rd and the 26th there were general rains, with heavy falls over most of the North Island. In the South Island few places recorded half the average for October, and large parts of Canterbury and Marlborough had deficits of over 80 per cent.

Temperatures. - Though there were no severe cold snaps, the average temperatures were almost everywhere considerably below normal The frosts, though unusually frequent, were not of great depth or severity, and though tomatoes, potatoes, and other garden crops were damaged, fruit-trees suffered comparatively little

Sunshine.—The month was remarkable for the amount of sunshine. Lake Taupo reports 281·4, Nelson 266·9, and Blenheim 261·5 hours

Storms and Pressure Systems.—During the first nine days conditions were fairly typical of spring. Two westerly depressions crossed the South Island, causing some rather boisterous north-westerly winds as they approached and south-westerlies as they passed away. There were some heavy rains on the west coast of the South Island, but little elsewhere.

From this period onward high pressure was the rule, and the anticyclones were centred unusually far south. Southerly or south-easterly winds predominated and the situation was of a type which, though not very uncommon in summer, was the reverse of what is expected in spring.

Between the 13th and the 18th a moderate cyclonic depression passed across the north Tasman Sea and by Norfolk and the Kermadec Islands. On the 16th it caused easterly gales in the far North and some rain fell in the northern and eastern districts of the North Island. The centre was too far north to affect New Zealand greatly. It did cause, however, an increased flow of air from the south and south-east, and it was during this period that the worst of the frosts were experienced.

From the 23rd to the 27th a shallow cyclone developed in the northern part of a depression approaching from the Tasman Sea and moved slowly across the North Island. This was responsible for the general rains already referred to and snow on the ranges, expecially in the South Island. South-easterly gales were experienced in the Cook Strait area. On the 24th there were some severe thunderstorms in the Auckland Province.

From the 28th onwards the weather was again dominated by an anticyclone. On the 31st south-westerly winds on the southern side of it began to cause rain on the west coast of the South Island.

RAINFALLS FOR OCTOBER, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Fall.	Total Rainfall to Date.	Average Rainfall to Date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	0·79	7	0·33	5·27	50·72	48·93
Russell	1·52	7	0·88	3·83	86·47	51·67
Whangarei	1·06	12	0·75	4·76	74·33	54·71
Auckland	2·07	6	1·02	4·06	38·11	42·58
Hamilton	1·12	7	0·58	4·60	32·97	42·03
Rotorua	4·21	6	2·68	5·19	40·71	47·10
Kawhia	..	..	..	5·15	..	45·90
New Plymouth	3·14	..	..	5·46	48·06	50·79
Riversdale, Inglewood	4·37	9	1·72	10·41	74·68	87·57
Whangamomona	..	..	..	8·43	..	64·53
Hawera	2·27	8	1·07	4·65	33·30	38·18
Tairua	2·78	3	1·69	5·81	46·65	56·44
Tauranga	4·90	4	3·58	5·11	47·19	45·52
Maraehako Station, Opotiki	1·86	7	0·74	5·35	51·82	47·20
Gisborne	3·36	10	1·50	2·67	35·16	39·95
Taupo	1·97	8	0·99	4·31	27·20	37·43
Napier	2·71	10	0·93	1·89	22·18	26·12
Hastings	2·09	10	0·83	2·11	18·07	28·16
Taihape	1·87	13	0·40	3·50	25·75	30·06
Masterton	1·79	11	0·40	3·24	27·99	32·78
Patea	2·06	8	1·07	4·25	34·50	37·28
Wanganui	1·45	3	0·67	3·46	25·59	30·18
Foxton	1·05	6	0·57	2·94	18·95	26·67
Wellington	0·94	7	0·30	3·51	28·07	36·38
South Island.						
Westport	4·02	7	1·45	8·70	64·25	79·50
Greymouth	4·27	9	1·70	10·74	77·31	83·80
Hokitika	5·10	10	1·96	11·81	83·45	94·12
Ross	..	..	..	14·77	..	109·58
Arthurs Pass	..	..	..	20·33	..	131·69
Okuru, South Westland	4·39	3	2·62	15·21	110·47	120·90
Collingwood	0·78	7	0·37	10·08	63·76	82·03
Nelson	0·48	4	0·26	3·50	25·50	31·94
Spring Creek, Blenheim	0·34	5	0·15	2·56	20·41	25·79
Seddon	0·43	4	0·36	2·23	20·27	20·99
Hanmer Springs	1·89	9	0·35	3·92	28·61	37·83
Highfield, Waiau	1·32	9	0·31	2·60	19·07	28·12
Gore Bay	0·75	8	0·23	2·33	26·01	26·58
Christchurch	0·28	6	0·18	1·97	18·58	20·89
Timaru	0·30	6	0·15	1·98	16·36	18·31
Lambrook Station, Fairlie	0·34	5	0·18	2·06	14·65	20·37
Benmore Station, Clearburn	..	..	..	2·30	..	20·25
Oamaru	0·34	5	0·16	1·76	13·22	17·84
Queenstown	0·41	5	0·19	3·31	21·38	25·28
Clyde	0·09	2	0·08	1·62	11·68	12·12
Dunedin	0·80	8	0·33	3·09	33·05	29·97
Wendon	1·11	6	0·36	2·73	33·64	24·42
Balclutha	0·87	5	0·44	2·42	26·66	20·58
Invercargill	1·37	12	0·39	4·35	34·16	37·37
Puysegur Point	3·39	20	0·51	8·13	69·84	69·84
Half-moon Bay	2·48	13	0·41	5·17	48·07	48·10

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SEED CERTIFICATION.

SUMMARY OF OPERATIONS FOR SEASON 1936-37.

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THE Seed Certification Scheme of the Department of Agriculture has now completed its tenth year of operations, and the following report conveys to readers the scope of the scheme during the 1936-37 season. Extensive amendments were made to the scheme of white-clover certification before the commencement of the season under review, while the wheat-certification scheme was subject to minor amendments. The list of crops under certification was not extended in the past season.

With the commencement of the 1936-37 season higher standards of purity for the machine-dressed seed of most of the grasses and clovers were insisted upon. In general no difficulty has been experienced in dressing seeds to the required standard. The exception to this was in the case of cocksfoot-seed, where without amendment of the previous season's standard, considerable difficulty was experienced in dressing lines satisfactorily.

A 13-per-cent. increase in the applications received for certification brought the total number for the 1936-37 season above the 3,500 mark. This increase was due largely to the reorganization of the white-clover scheme, supported in smaller measure by increases in the number of wheat and potato crops under certification. A reduction in the perennial rye-grass areas was sufficient to offset to a large extent the above-mentioned increases however.

GOVERNMENT STOCK SEEDS.

The Department combined its policy of producing supplies of certified "Government stock" seeds under contract in the past season, when 750 bushels of perennial rye-grass and 1,000 lb. of white clover raised from selected nucleus stock seed was readily disposed of through commercial channels. It was unfortunate in this respect that the perennial rye-grass-seed harvest was below average, as orders for this seed were more than double the quantity of seed available for distribution. One thousand pounds of cocksfoot seed of a strain selected by Lincoln College was also produced under the supervision of the certification organization and distributed by the College authorities for further seed-production.

PERENNIAL RYE-GRASS.

Applications for the certification of perennial rye-grass-seed were only 72 per cent. of the number received in the previous season, the reduction being greatest in the number of areas eligible to produce "permanent pasture" seed. Average yields per acre were also low. These factors combined resulted in a reduction of well over 50 per-cent. in the total quantity of seed certified, which amounted to under 130,000 bushels for the season. In addition, the germination-capacity of much of this seed was below normal, resulting in a general shortage in the supply of the certified product.

Included in the 22,500 bushels of mother seed certified is the produce of over 300 acres sown out with certified Government stock seed in the autumn of 1936. This acreage produced over 5,000 bushels of machine-dressed seed, all of which proved to be of high quality in regard to type.

COCKSFOOT.

A slight reduction in the acreage of cocksfoot-seed entered for certification was recorded for the 1936–37 season, while a similar reduction was shown in the quantity of seed harvested. The Akaroa district has been responsible for these reductions, the acreage and quantity of seed harvested in mid-Canterbury (the only other district of importance) having increased quite appreciably.

Seasonal conditions, particularly on Banks Peninsula, were such as to mitigate the production of good-quality seed. Seed from the district mentioned was particularly light, and extreme difficulty was encountered in dressing the material to the quite reasonable standard required for certified seed, the main obstacle in this respect being the high percentage of kernel-less seeds present in many lines. This point is demonstrated by the fact that of 150,000 lb. of Akaroa-grown seed submitted for purity test after machine-dressing half this quantity failed to reach the necessary standard of purity.

The position in other districts was much easier, the percentage of rejections on purity being very little higher than in previous seasons.

WHITE CLOVER.

Commencing with the 1936–37 season an entirely new procedure was adopted in the certification of white-clover seed. It having been proven that use could be made of a chemical test on seedlings to determine type of clover, the system of plot testing, field inspection, and paddock-branding was replaced by a system necessitating temporary sealing of machine-dressed seed pending the results of the chemical test on an officially drawn sample of the seed.

The result of this alteration has been a remarkable increase in the quantity of seed receiving recognition as certified seed. Whereas in the 1935–36 season 56,000 lb. of seed was accepted under the certification scheme, from January to September of 1937, 460,000 lb. of seed was tested and approved as certified. This quantity is greater than the total quantity of seed certified during the previous eight years from the inception of a scheme of certification covering white-clover seed.

BROWN-TOP.

The certification of brown-top seed has now become relatively stabilized, fluctuations from year to year in the volume of the work undertaken being almost entirely attributable to seasonal variations. In the 1936–37 season 371,000 lb. of seed was finally sealed, this being a 75-per-cent. increase on the previous season's total. It is estimated that at least three-fourths of the brown-top harvest receives the official endorsement of certification in each season.

RED CLOVER.

Once again the demand for certified Montgomery red clover has far exceeded the supply—this despite the fact that the quantity of machine-dressed seed certified in the 1936-37 season exceeded the previous season's production of 23,500 lb. by 20 per cent. Actually the acreage entered in the season under review was more than double that for the 1935-36 season, but yields of seed during 1936-37 reacted against a corresponding increase in the total amount of seed certified. That Montgomery red clover under certain conditions produces a heavy seed yield is evidenced by the fact that one area in Hawke's Bay in the past season returned a yield of over 600 lb. per acre.

ITALIAN RYE-GRASS.

The acreage under Italian rye-grass certification has again shown a considerable increase, being 300 acres in excess of the 1935-36 season's figure of 378 acres.

The yield per acre of machine-dressed seed has fallen appreciably, but nevertheless over 12,000 bushels of seed were finally sealed and tagged as certified seed.

PHALARIS TUBEROSA.

The certification of *Phalaris tuberosa* has not advanced in the way that might have been expected. Ten areas comprising 85 acres were entered for certification in the season 1936-37, but no area produced a satisfactory yield of seed, and from the 33 acres harvested 1,500 lb. of machine-dressed seed was obtained.

SEED WHEAT.

The seed-wheat-certification scheme was subject to certain amendments prior to the commencement of the 1936-37 season. In the past many crops had been rejected at field inspection on the grounds that the sample of grain from these crops would not be satisfactory. It was decided to allow these crops to proceed to the grain-inspection stage, when an inspection of the grain sample itself would be the deciding factor in acceptance or rejection of the crop. This has caused a lower percentage of rejections in the field under the heading "general poor quality."

A second amendment was in the nature of a decision that only that wheat finally sealed and tagged after machine-dressing would be officially recognized as certified. This has resulted in a greater proportion of the accepted wheat being machine-dressed, giving to purchasers the benefits attached thereto, and at the same time eliminating an apparent weakness of the scheme that certified seed was not necessarily sealed and tagged.

General increases are again recorded in the scope of seed-wheat certification, acreages having increased by nearly 50 per cent. and the quantity of seed sealed and tagged having almost doubled.

It is of interest to note that the variety Cross 7 now holds pride of place in the quantities certified of the various varieties. Over 40 per cent.

of the 8,000 acres inspected was comprised of this variety, while, of the 47,500 bushels of seed machine-dressed, over 21,000 bushels was similarly comprised.

SEED POTATOES.

An increase of over two hundred entries for seed-potato certification was recorded for the 1936–37 season, bringing the total number of crops inspected for the season to 891. Of these, 20 per cent. were rejected for various reasons, while 80 per cent. were passed for certification purposes.

An extension of the scheme to cover crops entered from the Ohakune district was made at the commencement of the season, but apart from this the main development in the scheme has been in the Canterbury district.

The percentage of rejections is higher than has been the case for a couple of seasons. Particularly is this so in regard to crops rejected on account of the presence of foreign varieties beyond the maximum permissible percentage. In a proportion of cases this rejection has been occasioned by the admixture of varieties due to self-sown plants originating from a previous potato crop. In other cases the natural increase of the Northern Star variety, due to its tendency to produce large numbers of tubers, together with the fact that the owner of the crop has not given attention to the removal of plants of this variety, has led to rejection. It is quite established, however, that the question of foreign varieties can be controlled by the exercise of adequate care on the part of the farmer.

The Aucklander Short Top is still the main variety under certification and is in fact increasing in acreage at a more rapid rate than most other varieties. Next in order is the Dakota variety, while the recent introduction, Inverness Favourite, has risen to fifth in the order of importance in the course of three seasons.

In all, over 3,000 tons of seed potatoes were inspected after grading and accepted as finally certified seed. For the first time an appreciable export of certified seed took place, when approximately 300 tons of hand-picked seed was shipped to South America.

BRASSICA CROPS.

Owing to a failure of the nucleus stocks, no rape-seed of the Broad Leaf Essex type was sown out to produce certified seed in the 1936–37 season. Three areas of the Giant type, comprising 30 acres, were harvested and produced 111 cwt. of seed, giving an average yield of 411 lb. per acre. All the seed produced was rapidly absorbed into commercial channels.

GENERAL.

The accompanying table gives the quantities of the various seeds certified since the inception of seed certification in 1927 and also shows the estimated value of the seed certified in each season.

It should be noted that this table includes only seed in a machine-dressed or graded condition, and does not include seed harvested but not submitted for machine-dressing, or (in the case of potatoes) tuber inspection.

Persons or firms interested in the complete tabulated results for the season may obtain copies on application to the Director of the Fields Division, Department of Agriculture, Wellington.

Table giving Quantities of each Seed certified and Estimate of the Total Value of Seed certified in each Season.

Seed.	Chief Consideration upon which Certification is based.		Quantities of Seed finally certified.									
			1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.	1935–36.	1936–37.
Potatoes	Varietal purity, cropping-power, and freedom from virus disease	Tons	217	249	511	760	818	938	1,806	1,821	2,845	3,132
Wheat	Varietal purity and freedom from loose and stinking smuts	Bush.	3,840	11,682	16,714	4,060*	1,283*	7,001	6,012	11,110	25,646	47,465
White clover ..	Age of pasture, 1928–31; type of clover, 1931–37	lb.	..	10,595	69,015	67,242	6,131*	33,731	20,337	93,381	56,092	460,930
Perennial rye-grass	Genuine perennial type .. .	Bush.	..	..	17,052	45,982	81,186	245,667	119,019	182,386	279,305	129,495
Brown-top ..	Freedom from red top (*Agrostis palustris*)	lb	..	..	170,071	171,083	198,343	138,843	118,978	384,588	212,734	371,358
Cocksfoot ..	Type as exemplified in the produce of Akaroa Peninsula	„	.	..	..	..	171,720	622,765	200,560	715,982	657,319	334,374
Red clover ..	Type conforming to that of English-grown Montgomery red clover	„	..	.	..	.	1,550	3,763	17,263	32,193	23,620	28,140
Brassicas	Varietal purity and freedom from disease	„	..	.		..	..	..	22,515	522	24,503	12,432
Italian rye-grass ..	A rapid-growing high-producing type, showing recovery after cutting	Bush.	..	.	.	..	..	..	..	5,121	6,669	12,549
Phalaris tuberosa ..	Freedom from other species ..	lb.	..	.		..	.	.	..	..	2,701	1,533
Estimated value of seeds finally certified			£2,070	£4,889	£30,328	£40,048	£57,358	£142,585	£79,018	£154,725	£184,501	£168,845

* Reductions accounted for by changes in regulations.

Total estimated value of seed certified (1927–37), £864,367.

LAMBING PERCENTAGES.

ESTIMATES FOR THE CURRENT SEASON.

THE following are the estimates of the current season's lambing in New Zealand, computed from estimated average percentages furnished by Inspectors of Stock :—

NORTH ISLAND.

County.	Breeding-ewes.	Estimated Percentage of Lambs.	Estimated Number of Lambs.
AUCKLAND DISTRICT.			
Mongonui	31,033	79	24,516
Whangaroa	13,251	80	10,601
Bay of Islands	57,814	86	49,720
Hokianga	54,267	81	43,956
Whangarei	100,038	82	82,031
Otamatea	68,258	82	55,972
Hobson	69,419	83	57,618
Rodney	68,005	75	51,004
Great Barrier Island	7,188	67	4,816
Waitemata	66,158	89	58,881
Eden	2,020	85	1,717
Manukau	54,689	96	52,501
Franklin	95,631	96	91,806
Coromandel	41,918	78	32,696
Thames	10,922	97	10,594
Hauraki Plains	9,110	95	8,654
Ohinemuri	10,456	89	9,306
Waikato	85,811	96	82,379
Raglan	258,023	87	224,480
Waipa	132,659	104	137,965
Piako	96,220	100	96,220
Matamata	135,066	100	135,066
Rotorua	46,199	91	42,042
Taupo	6,662	90	5,996
Taumarunui	84,118	89	74,865
Kawhia	49,484	88	43,546
Otorohanga	92,758	95	88,120
Waitomo	253,834	95	241,142
Ohura	92,244	89	82,097
Kaitieke	53,094	82	43,537
Tauranga	52,395	92	48,203
Whakatane	32,442	84	27,251
Opotiki	50,216	86	43,186
District totals	2,281,402	90·404	2,062,484
GISBORNE - HAWKE'S BAY DISTRICT.			
Matakaoa	66,775	83	55,423
Waiapu	252,693	71	179,412
Uawa	123,626	80	98,901
Cook	455,323	82	373,365
Waikohu	358,761	81	290,596
Wairoa	376,038	81	304,591
Hawke's Bay	912,238	70	638,567
Waipawa	346,534	77	266,831
Waipukurau	123,177	89	109,628
Patangata	476,022	75	357,016
Weber	53,863	82	44,168
Dannevirke	235,318	94	221,199
Woodville	69,271	90	62,344
Pahiatua	142,841	93	132,842
Akitio	155,950	92	143,474
District totals	4,148,430	79·026	3,278,357

LAMBING PERCENTAGES—*continued.*

NORTH ISLAND—*continued*

County.	Breeding-ewes.	Estimated Percentage of Lambs.	Estimated Number of Lambs.
	WELLINGTON DISTRICT.		
Clifton	57,078	92	52,512
Taranaki	18,864	99	18,675
Inglewood	35,969	98	35,249
Egmont	19,238	107	20,585
Stratford	61,415	92	56,502
Whangamomona	46,896	90	42,206
Eltham	45,450	95	43,177
Hawera	67,884	104	70,599
Waimate West	5,491	102	5,601
Patea	196,715	96	188,846
Waitotara	139,918	95	132,922
Waimarino	155,637	87	135,404
Wanganui	282,452	91	266,031
Rangitikei	919,546	93	855,178
Oroua	203,862	107	218,133
Kairanga	106,355	96	102,221
Kiwitea	214,800	100	214,800
Pohangina	111,537	97	108,191
Manawatu	140,574	91	127,922
Horowhenua	114,052	95	108,349
Hutt	74,377	82	60,989
Makara	47,502	73	34,676
Featherston	325,944	89	290,090
Wairarapa South	165,273	89	147,093
Masterton	333,570	80	266,856
Castlepoint	97,694	81	79,132
Eketahuna	109,833	81	88,965
Mauriceville	42,630	80	34,104
District totals	4,140,556	91·896	3,805,008
	NORTH ISLAND DISTRICTS		
Auckland	2,281,402	90·404	2,062,484
Gisborne-Hawke's Bay	4,148,430	79·026	3,278,357
Wellington	4,140,556	91·896	3,805,008
Totals, North Island	10,570,388	86·523	9,145,849

COMPARISONS WITH PREVIOUS YEARS.

The following table shows the estimates for the current season's lambing in the North Island, together with the figures for the five previous years. The actual number of lambs tailed is also given.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
1937	10,570,388	86·52	9,145,849	..
1936	10,300,826	90·50	9,322,476	9,423,240
1935	9,697,231	83·68	8,114,361	8,500,075
1934	9,524,065	88·70	8,447,643	8,555,477
1933	9,318,943	91·23	8,502,050	8,385,569
1932	9,170,996	89·16	8,177,657	7,988,569

LAMBING PERCENTAGES—*continued.*

SOUTH ISLAND.

County.	Breeding-ewes.	Estimated Percentage of Lambs.	Estimated Number of Lambs.
MARLBOROUGH-NELSON-WESTLAND DISTRICT.			
Waimea	167,487	74	123,940
Takaka	26,187	69	18,069
Collingwood	12,772	82	10,473
Buller	2,901	94	2,727
Inangahua	11,284	93	10,494
Murchison	33,118	78	25,832
Grey	24,732	107	26,463
Westland	35,302	102	36,008
Sounds	103,681	73	75,687
Marlborough	192,694	76	146,447
Awatere	207,210	82	169,912
District totals	817,368	79·040	646,052
CANTERBURY-KAIKOURA DISTRICT.			
Kaikoura	113,122	86	97,285
Amuri	228,471	72	164,499
Cheviot	141,185	89	125,655
Waipara	293,468	87	255,317
Ashley	65,368	84	54,909
Kowai	67,225	96	64,536
Oxford	82,881	100	82,881
Rangiora	42,383	93	39,416
Eyre	58,050	100	58,050
Tawera	56,473	71	40,096
Malvern	134,973	104	140,330
Paparua	35,428	105	37,199
Waimairi	4,965	94	4,667
Heathcote	9,510	89	8,464
Akaroa	95,676	107	102,373
Mount Herbert	41,641	99	41,225
Wairewa	73,571	104	76,514
Halswell	14,880	100	14,880
Springs	28,050	101	28,331
Ellesmere	90,046	92	82,842
Selwyn	166,785	81	135,096
Ashburton	758,496	97	735,741
Geraldine	244,225	84	205,149
Levels	162,968	112	182,524
Mackenzie	320,165	86	275,342
Waimate	459,621	96	441,236
Chatham Islands	43,779	73	31,959
District totals	3,833,405	91·994	3,526,516
OTAGO DISTRICT.			
Waitaki	451,873	94	424,761
Maniototo	252,958	91	230,192
Vincent	257,184	84	216,035
Waihemo	106,061	83	88,031
Waikouaiti	67,727	91	61,632
Taieri	167,092	86	143,699
Peninsula	12,924	98	12,666
Clutha	354,145	98	347,062

LAMBING PERCENTAGES—*continued.*

SOUTH ISLAND—*continued.*

County.	Breeding-ewes.	Estimated Percentage of Lambs.	Estimated Number of Lambs.
OTAGO DISTRICT—*continued.*			
Tuapeka	310,562	94	291,923
Bruce	204,523	91	186,116
Lake	131,849	76	100,205
Southland	1,293,029	100	1,293,029
Wallace	499,405	87	434,482
Stewart Island	1,584	80	1,267
District totals	4,110,916	93·193	3,831,100
SOUTH ISLAND DISTRICTS.			
Canterbury	3,833,405	91·994	3,526,516
Marlborough	817,368	79·040	646,052
Otago	4,110,916	93·193	3,831,100
Totals, South Island ..	8,761,689	91·348	8,003,668

The following table shows the estimates for the current season's lambing in the North and South Islands, and also the totals for the Dominion, together with the figures for the five previous years. The actual number of lambs tailed is also given.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
NORTH ISLAND.				
1937 ..	10,570,388	86·52	9,145,849	..
1936 ..	10,300,826	90·50	9,322,476	9,423,240
1935 ..	9,697,231	83·68	8,114,361	8,500,075
1934 ..	9,524,065	88·70	8,447,643	8,555,477
1933 ..	9,318,943	91·23	8,502,050	8,385,569
1932 ..	9,170,996	89·16	8,177,657	7,988,569
SOUTH ISLAND.				
1937 ..	8,761,689	91·35	8,003,668	..
1936 ..	8,368,135	90·10	7,539,576	7,442,781
1935 ..	8,115,186	89·45	7,259,281	7,196,542
1934 ..	8,047,361	89·88	7,232,750	7,134,015
1933 ..	7,890,756	88·14	6,955,252	6,889,128
1932 ..	7,892,064	88·42	6,978,494	7,027,059
DOMINION.				
1937 ..	19,332,077	88·71	17,149,517	..
1936 ..	18,668,961	90·32	16,862,052	16,866,021
1935 ..	17,812,417	86·31	15,373,642	15,696,617
1934 ..	17,571,426	89·24	15,680,393	15,689,492
1933 ..	17,209,697	89·82	15,457,302	15,274,697
1932 ..	17,063,060	88·82	15,156,151	15,015,628

DISTRICT ESTIMATES.

The following table gives estimates of the current (1937) season's lambing for the several sheep districts in the Dominion :—

District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland..	2,281,402	90·404	2,062,484
Gisborne - Hawke's Bay ..	4,148,430	79·026	3,278,357
Wellington - West Coast ..	4,140,556	91·896	3,805,008
Marlborough-Nelson-Westland	817,368	79·040	646,052
Canterbury-Kaikoura ..	3,833,405	91·994	3,526,516
Otago (including Southland)	4,110,916	93·193	3,831,100
Dominion	19,332,077	88·711	17,149,517

PACKING APPLES AND PEARS IN STANDARD CASES.

WM. C. HYDE, A. T. DOUGLAS, and R. E. BINFIELD.

II.

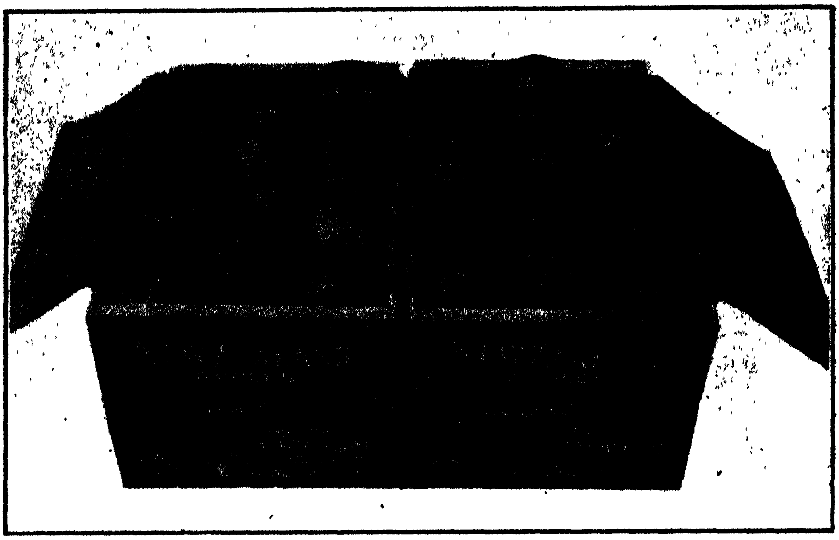
(Continued from p. 273)

As with all operations in the packing-shed, careful arrangements should be made to facilitate the work of packing and avoid unnecessary labour. With this object in view the bottom of the bin of sized and graded fruit, and the bottom of the box into which it is to be packed, should be at least 2 ft. 6 in. from the floor, so the box may be packed without stooping. Such details improve the pack and increase the output.

The box to be packed is placed in a sloping position on a special stand which allows the bottom bulge to be built in as packing proceeds. A tray of wrapping-paper, glazed side up, and held in position by a "paper needle," is provided on the packing-stand, so that it may be readily reached by the left hand of the packer. With the help of a rubber finger-stall on the middle finger on the left hand, the packer takes a wrapping-paper and at the same time an apple with the right hand. He tosses the apple into the middle of the paper, and with the right hand brings up the lower half of the paper to cover the apple. He then turns the palm of the left hand down, and the right hand up with a half-twisting movement on the covered apple between them, and places the apple in the box.

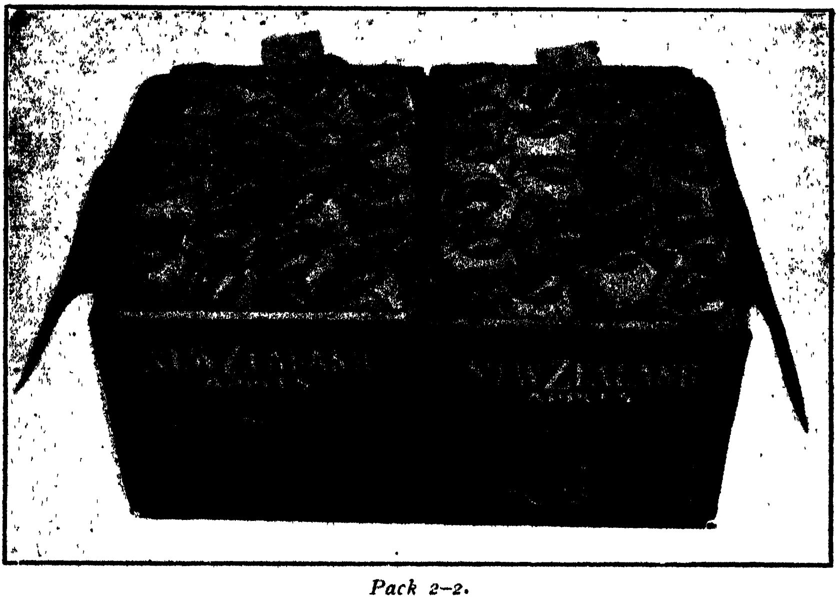
POSITION OF APPLES.

The position of the apples in the box is now to be considered. They are not placed at random, but in a systematic manner, varying slightly, but not in principle, according to the size and shape of the fruit. The system is known as the "pocket" pack, as each apple lies between, instead of directly on, those below. This gives the pack elasticity, prevents bruising, and enables the packer to finish the pack at the right height, which obviously is the most important feature. No case of apples should be nailed down unless the pack is right in that respect.



Pack 2–1

Rows, 5 4	Rows, 5-5
Layers, 3.	Layers, 3.
Count, 41	Count, 45.



Pack 2–2.

Rows, 6–6.	Rows, 5–5.
Layers, 4.	Layers, 4.
Count, 96.	Count, 80.

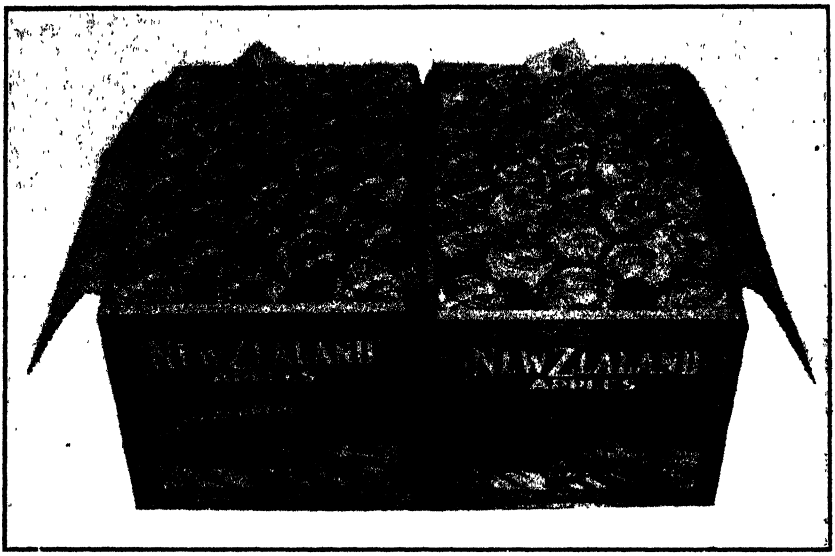
FIG. 7. SHOWING SOME OF THE COUNTS IN THE 2–1 AND 2–2 PACKS WHEN PROPERLY PACKED.

With the box in a sloping position and end on to the packer, if apples measuring 4 in. in diameter from cheek to cheek are wrapped and one placed in each of the lower corners, it will be found there is not sufficient room for the third apple to be placed between them in such a way that it touches the box-end, which is only 11½ in. across. It has to stand an inch or so off the box-end and project some distance in front of the two corner apples, leaving a "pocket" on each side. The fourth apple is placed in the pocket in front of number one, and the fifth apple in front of number two. If the sixth is then placed in front, or above, number three, we again have two pockets which should be filled, and the arrangement continued until the bottom layer is completed. With rather flat apples the number in the rows lengthwise of the case may be five in each; but with a more conical apple it may be 5–4—that is, 5 in each of the outside rows and 4 in the middle row. *The main axis of the apple—that is, the line from stem to calyx—should always be kept parallel with the length of the case, the stem of the fruit always pointing from the packer, except the last apples placed in the layer, which should be reversed, so that the stem-end is turned towards the packer, to avoid stem-punctures.* This pack is known as the *2–1 pack*; by adding these numbers together we get 3, which is the number of layers required to fill the case. The second layer is commenced by placing an apple in the space or pocket formed by the first three apples in the bottom layer.

With rather a smaller apple, say, 3¾ in. diameter, the three apples would lie snugly side by side against the end of the case, but that would make a "straight" pack instead of the more desirable "diagonal" or pocket pack. In this instance one apple should be placed in the left-hand bottom corner and the second half-way between it and the right-hand corner. By placing the third and fourth apples in the spaces between, number two is made secure in its position, and the layer is completed with apples in the same relative positions. This is known as a *2–2 pack*, and adding the numbers we get 4, which is the number of layers required to fill the case. The second layer is commenced by placing two apples above the spaces in the first layer.

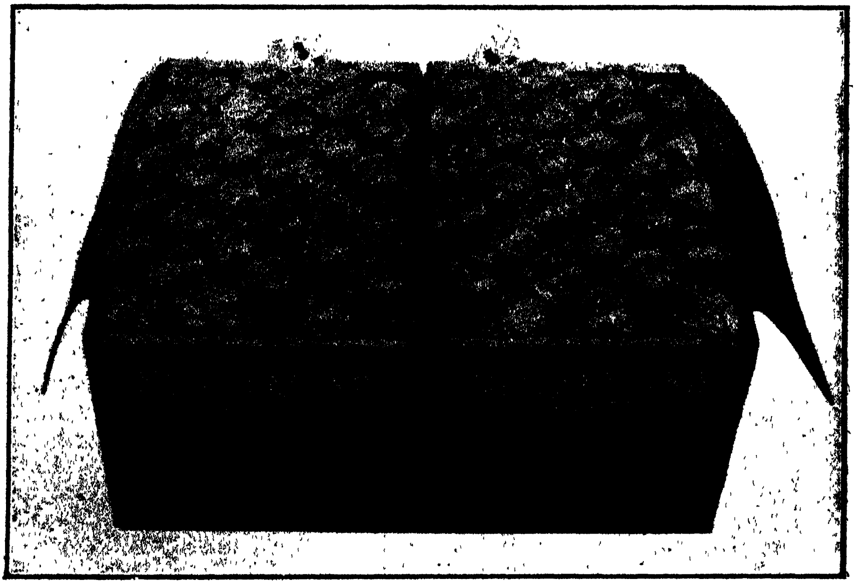
Medium-sized apples, of about 2¾ in. diameter, four of which lie loosely along the end of a case, but without room for a fifth, make what is known as a *3–2 pack*—that is, a wrapped apple is placed in each corner and one in the middle of the end of the case; the fourth and fifth apples lie in the two spaces between, thus making three pockets or spaces which are filled, and the layer completed with fruits in the same relative position. It takes five layers to fill the box in this way, the second layer being commenced by placing two apples above the two spaces in the bottom layer, next the lower end of the box.

Apples with a diameter of 2¼ in. to 2½ in. are packed by the following method: One is placed in the left-hand bottom corner of the box and two more are placed equidistant in the remaining space, so there are three spaces or pockets for the next row. The layer is then completed with apples in the same relative position. This is known as the *3–3 pack*, and six layers will be required to fill the



Pack 3-2

Rows, 6-5.	Rows, 5-6
Layers, 5	Layers, 5
Count, 138	Count, 150.



Pack 3-3.

Rows, 6–5.	**Rows, 5-5.**
Layers, 6.	**Layers, 6.**
Count, 198.	**Count, 180.**

FIG. 8. SHOWING SOME OF THE COUNTS IN THE 3-2 AND 3–3 PACKS.

case. As before stated, all *apples should lie on the cheek with the stem pointing directly from the packer, except the last row in a layer, which should be reversed.*

The following apple packs are generally most suitable for the standard bushel case :—

Packing Chart for Standard Apple Case.

Style of Pack (Crosswise).	Number in Rows (Lengthwise).	Number of Layers (Depth).	Size or Count.	Approximate Sizes.
				In.
2–1	4–4	3	36	4
2–1	5–4	3	41	4
2–2	3–3	4	48	3⅞
2–2	4–3	4	56	3¾
2–2	4–4	4	64	3⅝
2–2	5–4	4	72	3½
2–2	5–5	4	80	3⅜
2–2	6–5	4*	88	3¼
3–2	4–3	5†	88	3¼
2–2	6–6	4*	96	3
3–2	4–4	5	100	3
3–2	5–4	5	113	2⅞
3–2	5–5	5	125	2¾
3–2	6–5	5	138	2¾
3–2	6–6	5	150	2⅝
3–3	5–4	6†	162	2⅝
3–2	7–6	5	163	2⅝
3–2	7–7	5‡	175	2½
3–3	5–5	6§	180	2½
3–3	6–5	6	198	2⅜
3–3	6–6	6	216	2⅜
3–3	7–6	6	234	2¼
3–3	7–7	6	252	2¼
3–3	8–7	6	270	2⅛

* For flat apples. † For long apples. ‡ Flat apples only. § All apples.

In all minimum packs no fruit should be smaller than the size indicated for the packs in this chart.

MEETING THE BUYER.

The buyer naturally expects to receive a full case of fruit in good condition. To comply with this specification the packer should finish the case with a smooth surface on the top layer of fruit, the centre being approximately 1½ in. above the edge of the box and the ends about ¾ in. for tight packs and ½ in. for looser packs. These measurements will depend to some extent on the strength of the packer and the tightness of the packing, but when nailed down the pack should be solid, without bruising, with a ¾ in. bulge at the centre, top, and bottom.

The height of the finished surface of fruit in a packed box depends on selecting the correct pack and the size of the pockets. The latter should be carefully adjusted when placing the first layer in the case; and pressing the second layer well into them will retain the size set. The larger-sized apples in each pack, such as the 48 count in the 2–2 pack, and the 100 count in the 3–2 pack, and the 180 count in the 3–3 pack, should be placed rather loose in the bottom layer or the pack will finish too high and crush when lidded. This is probably the most common cause of a bruised pack. Not only should the bottom layer be loose, but the fruit towards the ends of the case should be looser than that across the centre. If the second layer is then well pressed down, the correct size of the pockets will be maintained and the top will finish at the right height with the requisite bulge. The smaller apples in each pack, however, such as 234 count in the 3–3 pack and 163 count in the 3–2 pack, should be packed tight in order to bring them up sufficiently high at the finish. *Care must always be taken to adjust the size of the pockets when placing the first layer of fruit in the box.* When two-thirds of that layer is in position the fruit should be pulled down firmly towards the packer without throwing the apples out of alignment; this will close up the pockets somewhat across the centre and provide the necessary bulge if the second layer is pressed well down into the pockets of the first layer in order to retain the size set for the pockets. With loose packs especially there is a tendency for the fruits in the first layer to be closer together at the lower end of the case. If this is not rectified before the second layer is commenced it will be found when the case is filled that the fruit will be higher at the end nearest the packer than at the other end.

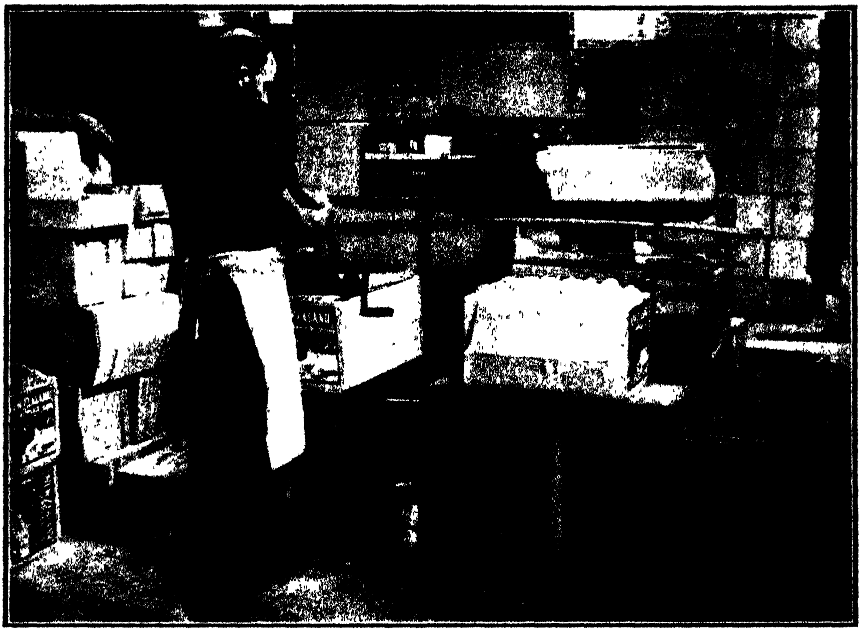


FIG. 9. WITH THE AID OF THE LIDDING-PRESS AND WIRING-MACHINE THE PACK IS COMPLETED.

STAMPING, NAILING-DOWN, AND WIRING.

So soon as a case is packed the packer's card should be inserted and the case then placed on the conveyer—which should be of one of the types illustrated, so that the bottom bulge is protected—where it reaches the nailing-down press. Where packer's cards are not in use it is the standard practice for the packer to mark the count per case in pencil at the bottom right-hand corner of the case. Care, however, should be taken to apply this neatly and legibly for the guidance of the nailer-down. There the box is examined to see that it is sound and all the nails are properly driven, the fruit is packed with a smooth finish, at the right height, and the packer's card is then filed.

The variety, count, and other necessary details which have not been overprinted on the label are then stamped on the case neatly with rubber stamps and indelible ink. The all-round corrugated pad if in use is now folded over tightly to avoid bulging at the sides, if a single pad is used it is placed squarely on, the two-piece lids and cleats are adjusted and held in position by the lidding-press and securely fastened with four nails each end through the cleats into the ends of the case. In doing this the operator, with his hands on the centre of the lid, exerts a pressure as the arms of the press come into operation, which has the effect of distributing the pressure equally through the pack and consolidating it evenly The box is then released from the press, and, if it is to be exported, it is tightly strapped with wire, applied not more than an inch from each end of the box, and then placed on its side in a stack not more than six cases high awaiting shipment. Soaking cleats in water assists in overcoming splitting during nailing.

HARVESTING THE PEAR CROP.

Mistakes are commonly made in judging the maturity of pears; possibly because they are judged on the same standard as apples, whereas their behaviour is somewhat different. Ripened on the tree they are of inferior quality, but picked so soon as they are mature, and ripened in a warm, humid atmosphere, the flavour and aroma develop to a maximum extent and the most is made of any qualities of that kind they possess. Experience is necessary for acquiring good judgment as to maturity; probably the most important sign is when the fruit parts from the tree in an easy natural manner when the weight is taken in one's hand and the fruit slightly raised. This behaviour, together with the size of the fruit and the season of the year, are the most useful indicators. Change in the colour of the skin is usually very slight at that stage; a colour-change, however slight, should usually be regarded as an urgent sign for harvesting pears. The harvesting of pears commences towards the end of January. The recognized commercial varieties are ready for picking according to the purpose for which they are required in approximately the following order: Commencing with William's Bon Chretien and Beurré d'Amanlis in the month of January; Louise Bonne de Jersey, Beurré Capiaumont, Beurré Clairgeau, Marie Louise, Beurré Bosc, Conference, Doyenné du Comice, Beurré d'Anjou, Packham's Triumph, Winter Cole, Beurré Diel, Vicar of Winkfield, Duchesse d'Angoulême, Joséphine de Malines, Glou Morçeau, Giblin's Nelis, Winter Nelis, Keiffer, Beurré Easter, L'Inconnue, and P. Barry—the latter reaching maturity during the month of April.

The class of land and locality in which pears are grown, amount of crop per tree, and weather conditions prevailing during the season are factors which considerably affect the maturing of pears.

PACKING PEARS IN THE STANDARD CASE.

Making and Labelling the Boxes.—The standard pear-case differs in size from the standard apple-case in depth only, and is known as the three-quarter pear-case.

The following are the dimensions of the standard pear-case :—

Inside measurement : 8½ in. by 11½ in. by 18 in.

Ends : 8½ in. by 11½ in. by ¾ in. or ⅝ in. (two pieces each planed on the outer side).

Sides : 8½ in. by 19½ in. by 5/16 in. (two pieces, one board for each side).

Tops and Bottoms : 5½ in. by 19½ in. by 3/16 in. (four pieces, two each top and bottom).

Cleats : 11½ in. by ¾ in. by 5/16 in. (four pieces, one across each end both top and bottom).

This case is packed on the wide side of the case.

The specification of the case as regards timber, nailing, labelling, marking, and wiring is practically similar to that for apples.

Grading and Sizing the Fruit.—Standard grades of pears and sizes packed are subject to slight alteration each season. Those set for the 1937 export season are as follows :—

"Extra Fancy Grade" : Pears of this grade shall be mature, sound, moderately clear skinned, well formed, carefully hand-picked from the tree, properly wrapped, true to name ; free from disease, skin-puncture, skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer.

"Fancy Grade" : Pears of this grade should be mature, sound, well formed, carefully hand-picked from the tree, properly wrapped, true to name ; free from disease, skin-puncture, skin broken at stem, and other defects which cause fruit to decay or which are likely to make the fruit unattractive to the consumer.

Individual fruits of either grade should carry not more than the percentage of blemish or spray injury indicated in the following general list with respect to each variety in the respective grades.

The following varieties of pears are approved for export. The maximum size of pears offered for export shall be 3 in. and the minimum size 2⅛ in.

Sizes to be as in attached list.

Variety.	Sizes.				Blemish.		Spray-injury.	
	Standard Pear-case.		Trays.					
	Max.	Min.	Max.	Min.	XF, %	F, %	XF, %	F, %
Bailey Berg	90	195	..	..	1	5	..	20
Beacon	90	195	..	..	1	5	..	20
Beurré Bosc	70	180	18	33	1	5	..	20
Beurré Capiaumont ..	90	195	..	..	1	5	..	20
Beurré Clairgeau ..	70	180	..	..	1	5	..	20
Beurré d'Amanlis	90	195	..	..	1	5	..	20
Beurré d'Anjou ..	90	195	18	33	1	5	..	20
Beurré Diel	90	165	..	..	1	5	..	20
Beurré Easter ..	90	165	..	..	1	5	..	20
Broompark	90	195	..	..	1	5	..	20
Chaumontel	90	195	..	..	1	5	..	20
Conference	80	180	..	..	1	5	..	20
Doyenné du Comice ..	80	195	18	33	1	5	..	20
Duchesse d'Angoulême	70	180	..	..	1	5	..	20
Elizabeth Cole ..	90	210	..	..	1	5	..	20
Giblin's Nelis ..	90	195	..	..	1	5	..	20
Glou Morçeau ..	90	165	..	..	1	5	..	20
Harrington's Victoria ..	70	180	..	..	1	5	..	20
Joséphine de Malines ..	90	210	..	..	1	5	..	20
Keiffer	70	180	..	..	1	5	..	20
L'Inconnue	90	210	..	..	1	5	..	20
Louise Bonne de Jersey	90	195	..	..	1	5	..	20
Madam Cole	90	210	..	..	1	5	..	20
Marie Louise ..	90	195	18	33	1	5	..	20
Packham's Triumph ..	80	180	..	..	1	5	..	20
P. Barry	70	180	..	..	1	5	..	20
Twyford Monarch ..	90	195	..	..	1	5	..	20
Vicar of Winkfield ..	70	180	..	..	1	5	..	20
Winter Cole	90	210	..	..	1	5	..	20
Winter Nelis	90	210	..	..	1	5	..	20

Only those varieties for which tray sizes are designated are acceptable packed in trays.

Pears in trays to be packed in wood-wool or in all-round corrugated straw-board wrap; strawboard to be of dimensions 30 in. by 17½ in. (approximately). Pears which are against the ends of the tray to be double-wrapped; the tray to be of a depth suitable to the size of pear, but any slack in the pack to be taken up with an extra pad of corrugated strawboard or wood-wool. Wrapping-paper of sizes 10 in. or 11 in. by 11 in. to be used for pears in trays, the size of wrap to be according to the size of pear. Where 11 in. by 11 in. is specified, 10 in. by 10 in. double wrapping may be substituted.

All pears in standard pear-cases to be packed with an all-round wrap of corrugated strawboard.

PACKING THE BOX.

What has been written about the packing of apples is also applicable to pears; the principle of the system is the same although the actual packs themselves are different.

In pear-packing the same diagonal pocket is used. When placing the pears in the case after wrapping, all stalks should be pointing away from the packer towards the opposite end of the case, with the exception of the last pears placed in the layer, which should be reversed with calyx to the end of the case to obviate stalk damage. It is essential also that the two end rows of pears in each layer should be double-wrapped to obviate chafing on the end of the case.

Extra care in the handling of pears, especially when the fruit is being handled in the bins, is necessary. Owing to this class of fruit having longer stalks generally in comparison to apples, more damage is liable to accrue from stem punctures.

Below is given two pear-packing charts; one applies to round varieties of pears, such as Winter Cole, Winter Nelis, &c., and the other applies to elongated varieties, such as Beurré Bosc, P. Barry, and Vicar of Winkfield, &c.

Packing Chart for Standard Pear-case.

Round Varieties.

Style of Pack.	Number in Rows (Lengthwise).	Number of Tiers.	Count.	Approximate Sizes.
				In.
3–2	4–3	4	70	3¼
3–2	4–4	4	80	3⅛
3–2	5–4	4	90	3
3–2	5–5	4	100	2⅞
3–2	6–5	4	110	2¾*
3–2	6–6	4	120	2¾
3–3	4–4	5	120	2¾
3–2	7–6	4	130	2⅝
3–3	5–4	5	135	2½*
3–3	5–5	5	150	2½
3–3	6–5	5	165	2⅜
3–3	6–6	5	180	2¼
3–3	7–6	5	195	2¼
3–3	7–7	5	210	2⅛
4–3	6–6	5	210	2⅛

*Indicates increased variation upwards.

Elongated Varieties.

Style of Pack.	Number in Rows.	Number of Tiers.	Count.	Approximate Sizes.
				In.
3–2	4–3	4	70	3
3–2	4–4	4	80	2⅞
3–2	5–4	4	90	2¾
3–3	4–3	5	105	2⅝*
3–2	6–5	4	110	2⅝
3–3	4–4	5	120	2½*
3–3	5–4	5	135	2½
3–3	5–5	5	150	2⅜
3–3	6–5	5	165	2¼
3–3	6–6	5	180	2⅛

*Indicates increased variation upwards.

STORAGE AND SHIPPING.

The fruits are seriously depreciated if large quantities are stacked close and left in an unventilated chamber for even a short period. This is particularly dangerous for early and mid-season fruit likely to ripen quickly and intended for shipment for a long distance. The packing-shed must be well ventilated and the stacks of fruit built so the air can circulate freely through them even when the packing-shed doors are closed. During the summer period especially the packed fruit should be despatched to the cool-store so soon as possible, as the heat and humidity at that season are liable to unduly hasten ripening.

Fungus diseases are responsible for serious losses in pears when they are cool stored for long periods. Grey mould *(Botrytis)* is often prevalent on the Winter Cole variety. This disease may be controlled to a considerable extent by the application of Bordeaux mixture a few days prior to picking the crop, by using only clean, dry cases for storing, and the wrapping of the fruit in copper-sulphate-treated wraps.

Losses of fruit from decay in storage and transit are to a great extent due to fungous spores getting access to the tissues of the fruit through injuries to the skin; commonly these are very slight and caused by bruising or nail marks which are hardly discernible and not noticed when they occur. The injury, however, is sufficiently large to provide ready entrance for the spores to grow and destroy the fruit. *This will be avoided by handling the fruit with care at all times, and packing and storing it under clean conditions.* The latter may be secured by sweeping up the packing-shed every afternoon when it is in use, promptly feeding waste fruit to stock; and spraying, washing, or fumigating the packing-shed and store with a reliable fungicide so soon as the season is finished. Attention should be given to the vicinity as well as the interior of the buildings.

WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

SEASON 1936-37.

A. STUART, Instructor in Agriculture, Invercargill.

THE past season has been one of the wettest experienced for many years, there being very little summer weather experienced. These conditions resulted in a very good growth of grass, although it was somewhat soft and lacking in quality. On account of the wet spring, the preparation of land for cropping was very much delayed, and the seed-bed at sowing-time was not all that could have been desired. The continuation of the wet conditions, with the soil lying in a wet semi-waterlogged condition most of the season, was rather disastrous to root and fodder crops, which were very late and heavily infected with disease. Oat crops were quite good, but great difficulty was experienced in getting them harvested.

Butterfat showed an increase of 1,178 lb., and this increase was largely due to the pasture-growth, which ensured a plentiful supply of feed throughout the season. The herd was increased from thirty-three to thirty-five. Only six calves were reared, compared with ten the previous year. Eighty-one breeding-ewes were carried, and ninety-seven lambs were got away as fats.

Towards the end of the season the committee went into ways and means of improving the experimental status of the farm, and as a result of its deliberations decided to change over from dairying to sheep. It was felt that running the farm as a dairy-farm was not conducive to extensive experimental work, and, with the exception of one or two experiments of a minor nature, the farm was more of a commercial dairy-farm than an experimental farm. There are numerous successful commercial dairy-farms in Southland, so that there is no necessity to have a demonstration farm dealing with the straight-out commercial aspects of dairy farming, but that a growing need for a farm that can be almost entirely devoted to experimental work where trials in connection with pastures and crops can be undertaken. In connection with such trials it was felt that sheep offered a better medium of measuring experimental results than did dairy cows, as with this latter class of stock it is not advisable to subject them to experimental conditions when the farm authorities require to rely on them for the farm finance. Sheep on the other hand lend themselves more to the ups and downs of grazing that must be associated with certain trials, and do not react financially to the same extent as do dairy cows, or, in other words, they will stand more abuse than the dairy cow without causing such a heavy loss in revenue. The committee recognize that the revenue from sheep will probably not be as great as that from dairy cows, but realize the necessity for development in experimentation, and are prepared to make this sacrifice in the interests of progress. In changing over to sheep the committee are by no means introducing a type of farming new to the Winton district, for actually fat-lamb production is more extensive in this area than is the production of butterfat. The time is quite opportune, also, to do some intensive experimental work in connection with the fat-lamb business both from the point of view of breeds and in connection with animal health.

ROOT CROPS.

Various trials were planned in connection with swedes and turnips, but owing to the late sowing, coupled with the wet cold season, this crop was practically a failure, and the experimental work was rendered null and void.

OATS.

A feature of interest was the growing of a block of Resistance oats. This variety is giving promise of excellent performance in Southland. The crop was spring-sown, and the block was situated in the centre of a field of Gartons Abundance. The Resistance was definitely better headed than the Gartons, although shorter in the straw, and approximately a week later maturing. There was ample evidence of its ability to stand up under adverse conditions, as it did not lodge, while the Gartons went down badly in parts. This characteristic is a valuable one for many Southland soil types.

CERTIFIED VERSUS UNCERTIFIED RYE-GRASS.

This trial, which was put down in the spring of 1933, was planned to determine the relative carrying-capacity and productive capabilities of the certified rye-grass and the uncertified type (see *Journal of Agriculture*, February, 1937). During the past season the area sown with the certified rye-grass has again carried more stock and further increased the production of butterfat when compared with the area sown with uncertified rye-grass. Details are as follows :—

Month.	Certified Rye-grass.		Uncertified Rye-grass.	
	Cowdays per Acre.	Butterfat per Acre.	Cowdays per Acre.	Butterfat per Acre.
1936.				
September	21·6	22·2	15·2	15·9
October	38·8	42·39	22·8	24·36
November	38·4	42·86	26·0	30·77
December	54·4	57·46	41·2	43·17
1937				
January	56·0	55·05	28·0	26·29
February	56·0	45·55	28·0	22·89
March	27·8	19·45	14·0	9·79
April	42·0	29·49	18·6	10·04
May	6·5	3·76	Nil	Nil
June	4·0	2·14	Nil	Nil
July and August	Nil	Nil	Nil	Nil
Total for year	345·5	320·35	193·8	183·21
Total to date since first grazed..	1,068·0	904·95	706·0	625·81

In addition 21·1 dry-stock days per acre have been obtained from the certified rye-grass, and 21·6 dry-stock days per acre from the uncertified rye-grass.

In June last an analysis of these two pastures was made and the result was as follows :—

——	Bare Ground.	Rye-grass.	White Clover.	Other Grasses.	Weeds.
Certified	23	49	23	29	0
Uncertified	22	19	38	27	12

At the time of writing the certified area presents a vigorous sward of rye-grass and white clover, although a few thistles and ragwort plants have made an appearance. White clover is dominant on the uncertified area, and the sward is rather open in places, giving entry to considerable quantities of thistles, ragwort, and brown-top in particular, together with other weed grasses.

PERSISTENCY OF CERTIFIED RYE-GRASS.

The experiment where 200 plots of different rye-grass strains were sown was carried on another season, and further demonstrates the persistency of the certified strains of rye-grass. Practically all of the plots sown with uncertified rye-grass have deteriorated to such an extent that rye-grass is practically non-existent in them, and the sward is composed of a little clover, much inferior grass, and weeds, and is very open and low in production.

REACTION OF PASTURES TO GRAZING AND HAYING.

In the spring of 1934 two areas were sown down with similar plots to study the reaction of the various species to haying and grazing respectively. One of these areas has been hayed during the past two seasons with intermittent grazings, between the hayings, while the other area has been grazed intermittently right through and not closed for hay at all. These plots were recently point analysed with the following results:—

	Area hayed.	Area grazed.
Bare ground	20·0	13·0
Rye-grass	62·5	64·0
White clover	21·0	50·0
Red clover	16·5	6·5
Cocksfoot	16·5	3·5
Goose-grass	9·0	..
Poa annua	..	8·0
Sweet vernal	1·0	1·0
Thistles	0·5	..

The interesting points disclosed by this analysis are—(1) Haying has resulted in the sward opening up slightly; (2) there has been no significant change in the rye-grass content; (3) white clover has been severely checked by haying, while the red-clover content has increased; (4) grazing has been detrimental to cocksfoot; (5) goose-grass has thrived under haying, while *Poa annua* has appeared with grazing.

RYE-GRASS GERMINATION TROUBLE.

In the spring of 1934, 314 strains of rye-grass were sown in individual plots to ascertain whether there did exist any strains of rye-grass that were immune to the fungus trouble that is associated with the seed harvested from the certified type of rye-grass in Southland in wet seasons. During the 1935–36 harvest the season was a good one for harvesting, the weather being dry, and as a result there was little trouble with the germination of any seed harvested. During the last season, however, wet conditions prevailed and much seed was ruined by the fungus. The plots were all harvested and the seed sent to the Department of Agriculture's Seed-testing Station, but unfortunately no results are yet to hand.

TIMOTHY STRAINS.

Thirty-five strains of Timothy were sown in 1934, to study the growth and production of the different strains under Southland conditions. There are some outstanding differences between some of these strains, and the plots were harvested so that larger plots can be sown, when the better strains will be studied under pasture-grazing conditions.

ACKNOWLEDGMENT.

Mr. D. H. McLean (Chairman), Messrs. J. J. Blakie, H. Carswell, and J. G. Hazlett, relinquished their places on the farm committee early in the year, after long and arduous service, and the following members were elected: Messrs. J. H. Thomson (Chairman), J. Ewan, R. King, and Dr. P. Gow.

The committee again wishes to acknowledge the material assistance received from the R. M. McKinnon Trust, and the subsidy from the Department of Agriculture.

THE COMMERCIALIZATION OF HYBRID VIGOUR IN THE TOMATO.

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SUMMARY.

(1) SEVEN varieties of tomatoes reasonably distinct in type were intercrossed in season 1935–36, and the first-generation hybrids were grown in season 1936–37, with appropriate parent plants as controls.

(2) Out of twenty-nine cross-pollinations made, twenty-seven gave hybrids yielding more than either parent. The two remaining crosses gave hybrids intermediate in yield but closely approaching that of the higher-yielding parent.

(3) Seventeen of the hybrids were earlier than the parent varieties, eleven were intermediate in maturity, and one was later.

(4) Hybrids from crosses between varieties with dissimilar characteristics gave a greater expression of hybrid vigour than hybrids from crosses between less dissimilar varieties. The one late hybrid was from a cross between two very similar early types.

(5) The increases obtained would seem to warrant the use of first-generation hybrid seed by commercial growers, as the labour entailed in producing such seed is comparatively small.

(6) It is probable that trial crosses would have to be made by the growers in each district to produce the type of hybrid most suitable for that district.

The tomato is normally a self-fertilized plant. Cross-pollination between varieties, especially if they are of distinct types, produces a measure of heterosis or hybrid vigour in the first-generation hybrid. Owing to subsequent segregation, this initial vigour is diminished in the later generations of the cross. The possibility of commercializing hybrid vigour depends upon its extent, and on the cost of producing hybrid seed. As about 200 seeds are produced from one tomato, the method offers practical possibilities, provided that it is possible to obtain large increases in yield, and/or a hastening of maturity.

SEASONS 1933–35.

(For a fuller account see J. W. Hadfield and R. A. Calder(1).)

Experiments were commenced in New Zealand in 1933 to investigate the degree of hybrid vigour obtainable in the tomato, and the possibility of its commercialization. Four varieties of tomatoes were intercrossed, and the progeny grown in season 1934–35, at Palmerston North, with their respective parents as controls. Weighings of fruit were made throughout the season, allowing a determination both of periodic and of total yield.

The results indicated that, in certain crosses, the yield was increased beyond either parent, and also that in some cases there was a hastening of maturity. It was found that crosses between dissimilar varieties gave a greater expression of hybrid vigour than between those of similar type, thus confirming the results of L. Alabouvette and A. Titard(2). In the above experiment three of

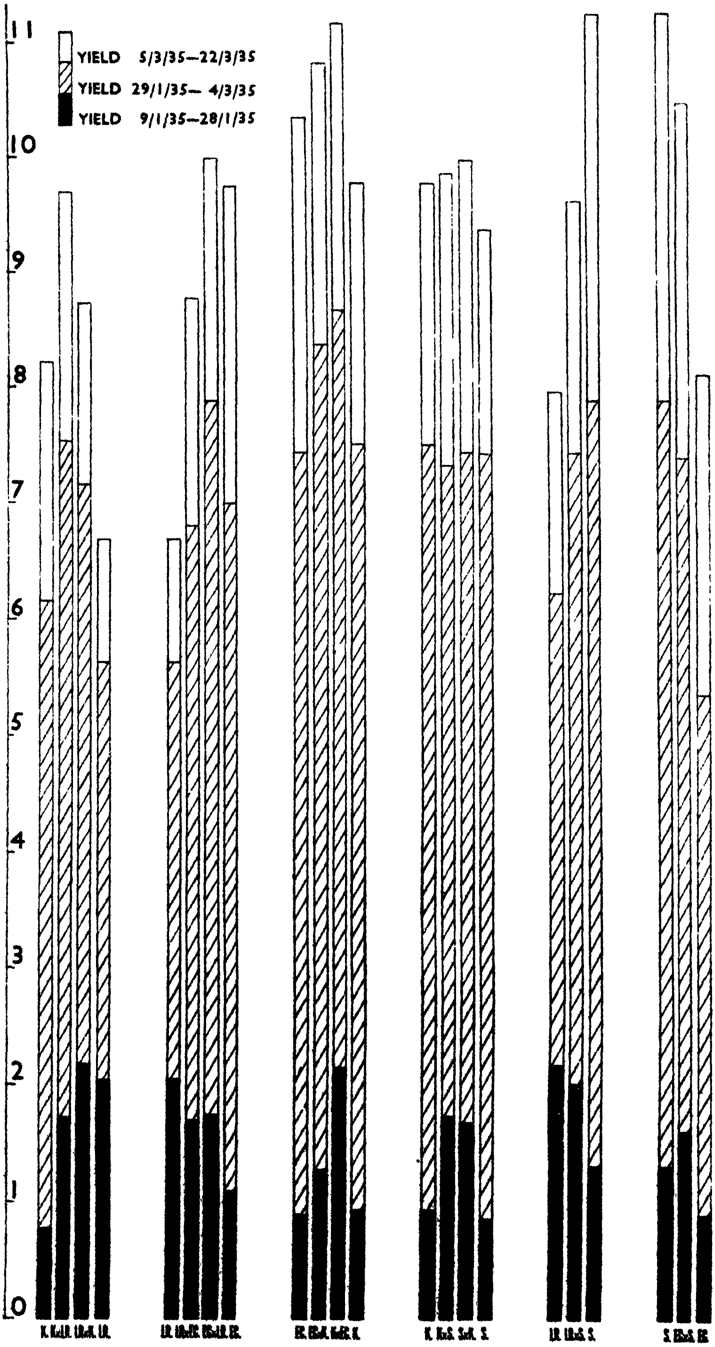

FIG. I. GRAPH SHOWING COMPARATIVE YIELDS PER PLANT IN THREE HARVEST PERIODS FROM FOUR VARIETIES AND THEIR HYBRIDS DURING 1934–35.

E.C. = Early Cluster, K. = Kondine, L.R. = Large Red, S. = Sunrise.

the four varieties used were of similar type, and gave little increase in yield over the parents (Fig. 1). It was resolved to continue the experiment in an endeavour to discover more satisfactory combinations. For this purpose a larger number of varieties which showed greater variation in type were used.

SEASONS 1935–37.

During season 1935–36 the following varieties of tomatoes were grown and cross-pollinated in as many combinations as possible: Abundance, Burwood, Earliana, Early Long Keeper, Kondine, Marglobe, and Market Favourite. Seed was obtained from the majority of crosses for trial in the 1936–37 season.

The young plants were planted out in November, 1936, staked, and pruned to a single stem in a manner similar to that adopted by the commercial grower. Each plot consisted of five plants, the hybrid plot being grown alongside the plots of the parent varieties, and at least four replications of each were planted where sufficient plants were available. Fruit was picked and weighed when it showed colour, up to three pickings per week being necessary in the middle of the season. There were twenty-four weighings altogether, and, by grouping these into periods, it is possible to obtain a measure of the relative earliness of the varieties and their hybrids.

GENERAL OBSERVATIONS.

The 1936–37 season was particularly unfavourable for tomato-growing in the Palmerston North district. The total rainfall and average temperatures were about normal, but the frequent occurrence of cold, wet, windy periods markedly reduced the number of sunshine hours. As a result, the crop made slow growth, the yields were poor, and the fruit ripened with difficulty.

In general the hybrid plants were more robust than the parents. Where the height of the two parents was similar, the hybrid was taller than either. Where one parent was much taller than the other, the hybrid was as tall, or very nearly as tall, as the tall parent.

Most of the hybrid plants gave a higher yield than the parent varieties. A majority gave also an increase in earliness measured as fruit picked in the first month of harvest. In only one case, in which two varieties crossed were similar in type, was the hybrid of later maturity than both parents.

In most cases the fruit was as high in quality as that of the parents, but the season was such that the fruit of even the standard varieties used was somewhat inferior in this respect. There was a tendency for the fruit to exhibit a strong resemblance to the maternal parent.

Summarized, the position was as follows:—

Number of crosses made = 29.
Number giving an increase in yield over both parents = 27.
Average increase in yield of these twenty-seven hybrids over the parents = 104·6 per cent.
Average increase in yield of all hybrids over the parents = 95 per cent.

Number giving yield intermediate between parents = 2.
Number giving lower yield than both parents = 0.
Number of crosses earlier than both parents = 17.
Average increase in yield of these seventeen hybrids over both parents in the first month of harvest = 144 per cent.
Number intermediate in maturity between parents = 11.
Number later than both parents = 1.

As yield and maturity are the two most important factors, these will be considered in relation to each cross. The twenty-four weighings are presented in three harvest periods and as a total. The season was very late, and hence the first period of harvest extended up to 13th March, 1937. During this period tomatoes were relatively scarce and retailed in the local market at about 8d. per pound. The second period, which was from 14th March to 13th April gave the heaviest yield. The market price during this period was from 4d. to 6d. per pound. The final period was from 14th to 30th April, when all fruit was picked owing to the onset of frosts. The retail price had dropped to 2d. to 3d. per pound.

The significance of early maturity is very obvious, since the monetary value of any increased yield obtained during the first period is so much greater than that of a corresponding increase later in the season.

Yields were much below those normally experienced in the district. However, the results would indicate that the hybrid plants were not so much affected by the adverse conditions as were the parent varieties.

The yields given are in each case the average of the several replications, each of five plants. In all cases the maternal parent of a cross is mentioned first. Notes are added on each cross, including a short description of fruit quality. The yields are summarized in Figs. 2 and 3.

Table 1 —Marglobe × Kondine.

—	Yield of Fruit in Pounds (Five Plants)			
	1	2	3.	Total.
Marglobe	1·11	3·74	1·16	6·01
Marglobe × Kondine	1·50	6·66	3·56	11·72
Kondine × Marglobe	1·71	4·77	1·66	8·14
Kondine	1·47	5·18	1·86	8·51

Kondine was the heavier-yielding and earlier parent. Marglobe × Kondine was as early as Kondine and yielded more heavily Kondine × Marglobe was very similar to Kondine in total yield and maturity.

The fruit-quality was generally good and up to the standard of Kondine. Marglobe tended to crack badly round the top of the fruit, and a few of the Marglobe × Kondine hybrids exhibited this fault.

Table 2.—Kondine × Market Favourite.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Kondine	1·47	5·18	1·86	8·51
Kondine × Market Favourite ..	2·69	5·90	4·47	13·06
Market Favourite × Kondine ..	2·44	7·03	4·72	14·19
Market Favourite	3·61	3·40	1·66	8·67

Both parents had a similar total yield, but Market Favourite was decidedly the earlier. The hybrids were intermediate in maturity, their higher yields in the second and third periods giving them a total yield greater than either parent. The fruit-quality of Kondine × Market Favourite was good, but that from the reciprocal was not so satisfactory. Both gave fruit medium in size.

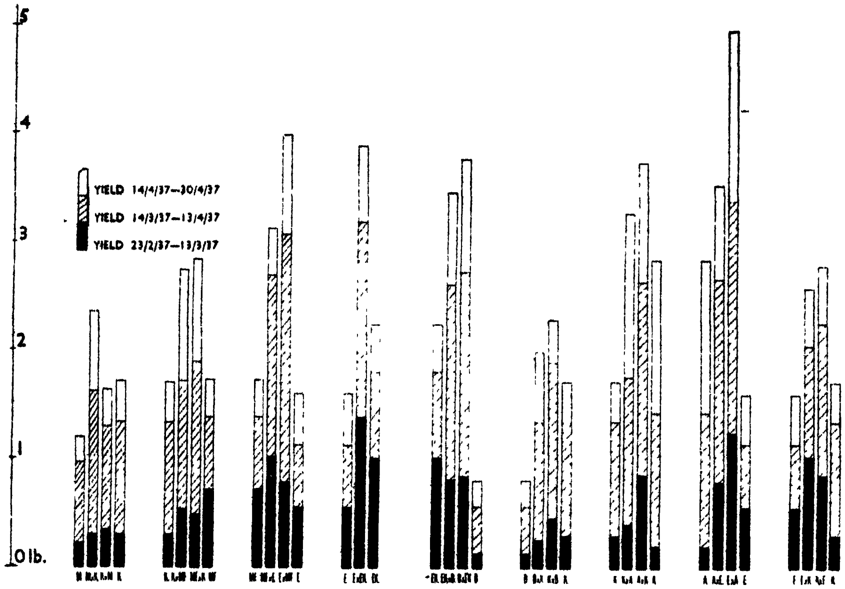

FIG. 2. GRAPH SHOWING COMPARATIVE YIELDS PER PLANT IN THREE HARVEST PERIODS FROM VARIETIES AND HYBRIDS DURING 1936-37.

A. = Abundance, B. = Burwood, E. = Earliana, E.L.K. = Early Long Keeper, K. = Kondine, M. = Marglobe, M F. = Market Favourite.

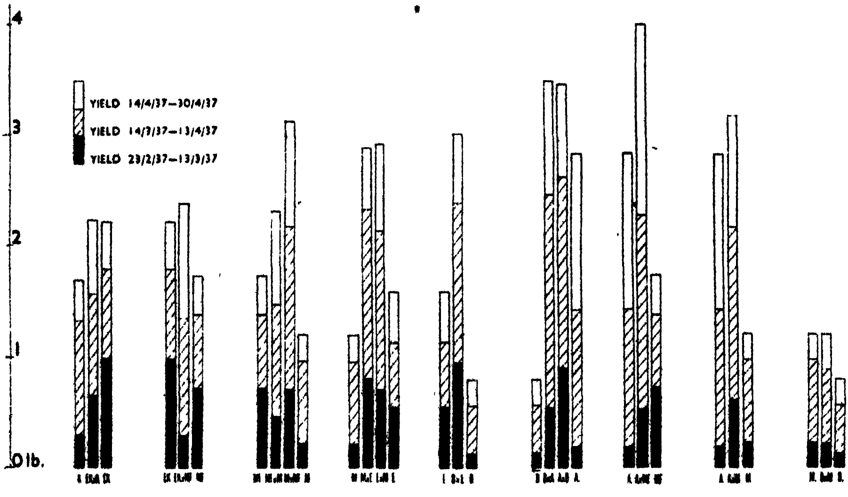

FIG. 3. CONTINUATION OF FIG. 2.

Table 3.—Market Favourite × Earliana.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Market Favourite	3·61	3·40	1·66	8·67
Market Favourite × Earliana ..	5·12	8·31	2·19	15·62
Earliana × Market Favourite ..	3·94	11·34	4·62	19·90
Earliana	2·75	2·90	2·28	7·93

The two parents gave somewhat similar yields, but, while both were early types, Market Favourite was the earlier one. Each of the hybrids was earlier than either parent, with total yields 80 per cent. and 130 per cent. respectively above Market Favourite. Fruit-size was medium to large, and of good quality.

Table 4 – Earliana Early Long Keeper

—	Yield of Fruit in Pounds (Five Plants)			
	1	2	3.	Total.
Earliana	2·75	2·90	2·28	7·93
Earliana × Early Long Keeper ..	6·87	9·04	3·38	19·29
Early Long Keeper	4·95	4·01	2·09	11·05

Early Long Keeper was a heavy-yielding, very early variety. Yet the hybrid was much earlier than either parent, and yielded roughly 75 per cent. more fruit of fairly good quality and of a size similar to the parents. The reciprocal was not available.

Table 5.—Early Long Keeper × Burwood.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Early Long Keeper	4·95	4·01	2·09	11·05
Early Long Keeper × Burwood ..	4·0	9·00	4·19	17·19
Burwood × Early Long Keeper ..	4·22	9·37	5·16	18·75
Burwood	0·66	2·16	1·14	3·96

Burwood produced low yields in all periods. Yet its hybrids produced almost as much fruit as Early Long Keeper in the early period, and at least twice as much in periods 2 and 3. As a result, total yields were 55 per cent. and 70 per cent. respectively above Early Long Keeper. However, the fruit was of rather poor quality, many being hollow. Fruit-size was medium to large.

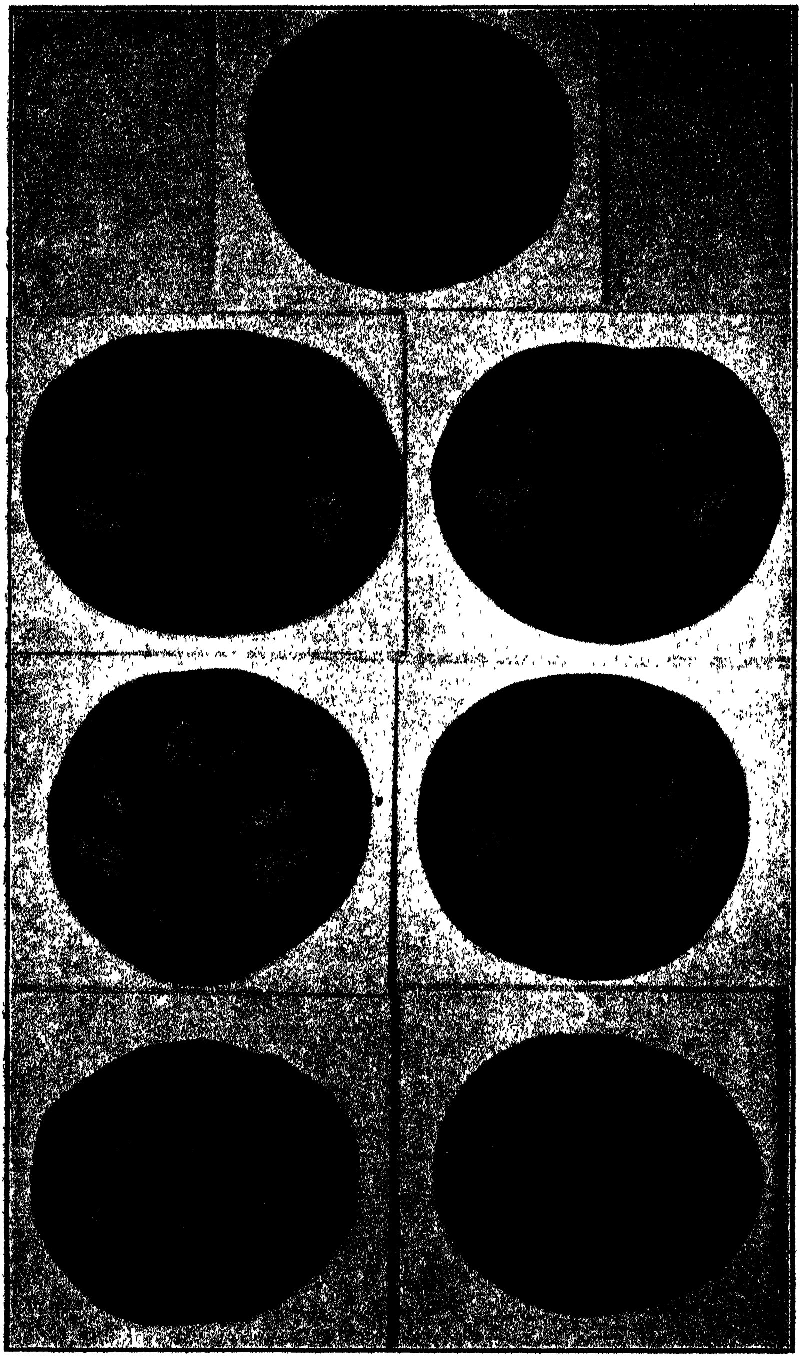

FIG. 4.

Top: Kondine. Left: Kondine × Market Favourite (upper), Market Favourite × Kondine, Market Favourite. Right: Kondine × Earliana (upper), Earliana × Kondine, Earliana.

Table 6.—Burwood × Kondine

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2	3.	Total.
Burwood	0·66	2·16	1·14	3·96
Burwood × Kondine	1·25	5·44	3·22	9·91
Kondine × Burwood	2·22	7·19	1·90	11·31
Kondine	1·47	5·18	1·86	8·51

Both hybrids produced a higher total yield than Kondine, but only one, Kondine × Burwood, was earlier than both parents. The fruit-quality was fair to good, and the size medium.

Table 7.—Kondine × Abundance.

—	Yield of Fruit in Pounds (Five Plants).			
	1	2	3	Total.
Kondine	1·47	5·18	1·86	8·51
Kondine × Abundance	1·96	6·77	7·53	16·26
Abundance × Kondine	4·28	8·81	5·45	18·54
Abundance	0·97	6·14	6·97	14·08

Abundance was a heavy-yielding, late-maturing variety, producing an abundance of small but well-shaped fruits. The hybrids were earlier than either parent, and produced a greater total yield. The fruit was of good quality, but there was a tendency for the small-fruit size of Abundance to be inherited.

Table 8.—Abundance × Earliana.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Abundance	0·97	6·14	6·97	14·08
Abundance × Earliana	3·94	9·34	4·25	17·53
Earliana × Abundance	6·19	10·66	7·81	24·66
Earliana	2·75	2·90	2·28	7·93

In this case both the hybrids were much earlier than either parent, and produced a much greater total yield. The cross Earliana × Abundance produced the highest-yielding plots in the trial. The fruit was of good quality, though rather small in size. Earliana × Abundance showed some cracking around the top of the fruit.

Table 9.—Earliana × Kondine.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Earliana	2·75	2·90	2·28	7·93
Earliana × Kondine	5·09	5·09	2·63	12·81
Kondine × Earliana	4·22	6·97	2·63	13·82
Kondine	1·47	5·18	1·86	8·51

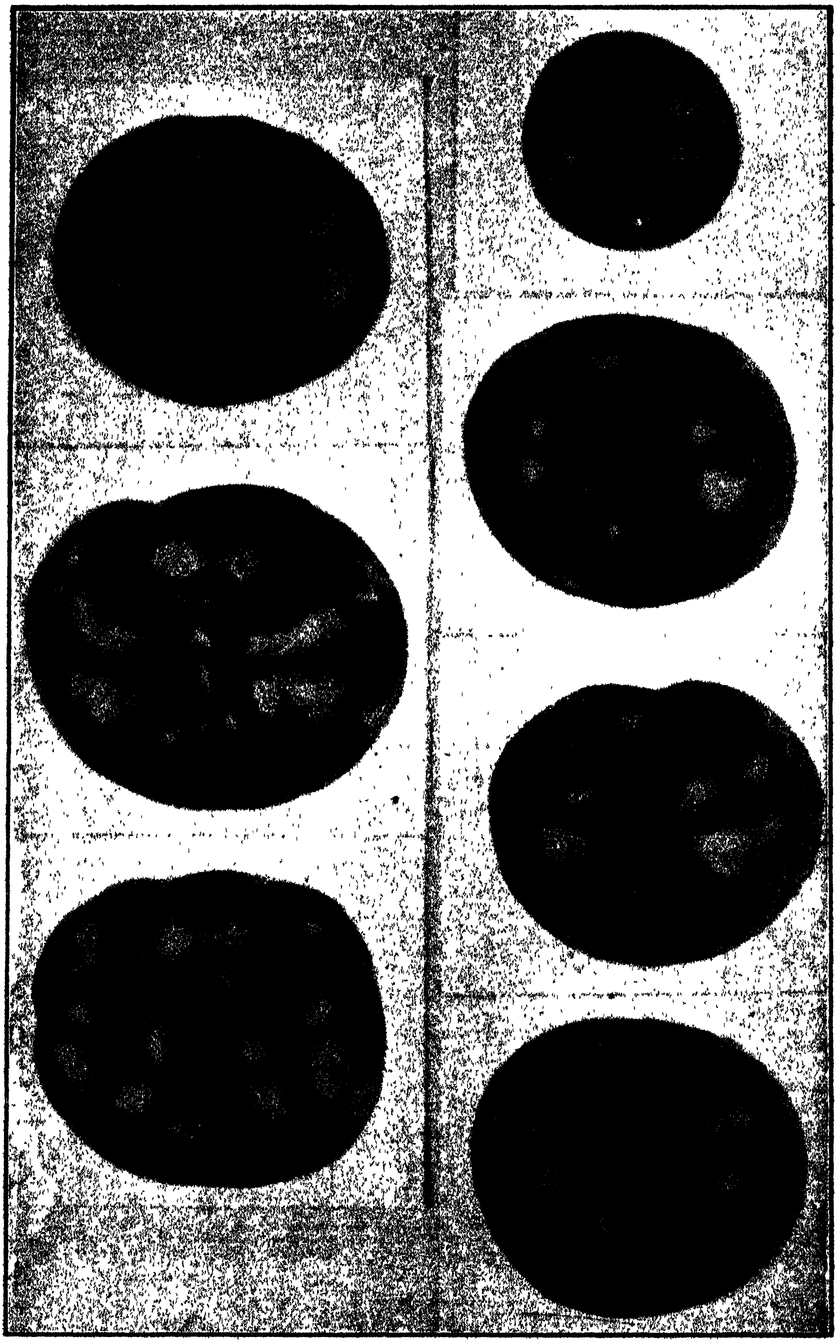

FIG. 5.

Left: Earliana (top), Earliana × Early Long Keeper, Early Long Keeper. **Right**: Abundance (top), Abundance × Kondine, Kondine × Abundance, Kondine.

In both hybrids earliness and total yield were improved when compared with the parents. The fruit was of good quality, and in appearance exhibited a close resemblance to the maternal parent. Fruit-size, medium to large.

Table 10.—Kondine × Early Long Keeper

—	Yield of Fruit in Pounds (Five Plants)			
	1	2	3	Total
Kondine	1·47	5·18	1·86	8·51
Early Long Keeper × Kondine ..	3·25	4·62	3·34	11·21
Early Long Keeper	4·95	4·01	2·09	11·05

The maturity of the hybrid was intermediate between the parents and the total yield similar to Early Long Keeper However, the hybrid was significantly better than Kondine in these respects. The fruit was of good quality, though medium to small in size. The reciprocal was not available.

Table 11.—Early Long Keeper × Market Favourite

—	Yield of Fruit in Pounds (Five Plants)			
	1	2.	3	Total
Early Long Keeper	4·95	4·01	2·09	11·05
Early Long Keeper × Market Favourite	1·47	5·25	5·25	11·97
Market Favourite	3·61	3·40	1·66	8·67

Early Long Keeper and Market Favourite were rather similar in type, though the former was somewhat the better of the two. The hybrid gave a slight increase in total yield, but was the only case where maturity of a hybrid was later than either parent. This was probably due to the similarity in parental type. The fruit was of fair quality, and medium in size.

Table 12.—Market Favourite × Marglobe.

—	Yield of Fruit in Pounds (Five Plants)			
	1.	2	3	Total
Market Favourite	3·61	3·40	1·66	8·67
Market Favourite × Marglobe ..	2·31	5·06	4·22	11·59
Marglobe × Market Favourite ..	3·50	7·37	4·78	15·65
Marglobe	1·11	3·74	1·16	6·01

Here maturity was equal to the earlier parent in one cross, but intermediate in the reciprocal. Both the hybrids gave higher yields than the parents, one being much higher than Market Favourite. The fruit-quality was good, but medium in size.

Table 13.—Marglobe × Earliana

—	Yield of Fruit in Pounds (Five Plants).			
	1	2.	3.	Total.
Marglobe	1·11	3·74	1·16	6·01
Marglobe × Earliana	4·0	7·65	2·75	14·40
Earliana × Marglobe	3·53	7·15	3·88	14·56
Earliana	2·75	2·90	2·28	7·93

Both the hybrids produced greater crops in all three periods, giving a greater increase in total yield. Fruit-quality was generally good, though some tended to split around the top. The fruit was fairly large in size.

Table 14.—Burwood × Earliana

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Burwood	0·66	2·16	1·14	3·96
Burwood × Earliana	4·72	7·15	3·16	15·03
Earliana	2·75	2·90	2·28	7·93

The hybrid available was much earlier than either parent, with a total yield 89 per cent. above Earliana. The fruit-quality was good, though of medium size.

Table 15.—Burwood × Abundance.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Burwood	0·66	2·16	1·14	3·96
Burwood × Abundance	2·65	9·63	5·12	17·40
Abundance × Burwood	4·44	8·63	4·16	17·23
Abundance	0·97	6·14	6·97	14·08

In this case there was a marked hastening of maturity on crossing, as well as some increase in yield. However, the fruit was too small for commercial requirements, due to the influence of the Abundance parent.

Table 16.—Abundance × Market Favourite.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Abundance	0·97	6·14	6·97	14·08
Abundance × Market Favourite	2·61	8·72	8·60	19·93
Market Favourite	3·61	3·40	1·66	8·67

The hybrid was intermediate in maturity, though tending towards the earlier parent. The total yield was much greater than either parent. The fruit was good, but small.

Table 17.—Abundance × Marglobe.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Abundance	0·97	6·14	6·97	14·08
Abundance × Marglobe	3·03	7·72	5·03	15·78
Marglobe	1·11	3·74	1·16	6·01

The hybrid was earlier than either parent, and slightly more productive. The fruit was of good quality, though rather small in size.

Table 18.—Marglobe × Burwood.

—	Yield of Fruit in Pounds (Five Plants).			
	1.	2.	3.	Total.
Marglobe	1·11	3·74	1·16	6·01
Burwood × Marglobe	1·03	3·34	1·63	6·00
Burwood	0·66	2·16	1·14	3·96

The hybrid showed no superiority to Marglobe. The fruit was of good quality and medium in size.

DISCUSSION.

It will be seen from a perusal of the results that practically all the hybrids have given total yields higher than both parents; the superiority was such that the average increase of all the hybrids over the parent varieties was 95 per cent. A majority also gave a decided increase in the yield of fruit picked in the early period.

It would be necessary to use first-generation hybrid seed each year, as the measure of increase obtained in the first-generation hybrids is not expressed to the same extent in later generations. However, tomato-seed retains its viability for a considerable time, so that enough seed could be produced in one season to last for several years. Very little labour is involved in the production of hybrid seed. A few plants of the desired parental types must be grown and cross-fertilized at the appropriate period. A description of the method of hybridization can be found in reference (1). With a little experience, over one hundred flowers can be crossed in one day. Allowing from one to two hundred seeds per fruit, enough seed would be produced to plant 1 to 2 acres.

Each district requires a certain type of tomato for its specific market requirements. It is, therefore, most likely that growers in each district would have to experiment, to some extent at least, with the object of discovering which two varieties, when crossed one with another, would give, not only a measure of earliness and increased yield in the first-generation hybrid, but also the type of tomato which they require.

ACKNOWLEDGMENTS.

The foregoing experiment and the preparation of this article were accomplished under the direction of Messrs. J. W. Hadfield and R. A. Calder.

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MANGELS.

SOME CHARACTERISTICS OF VARIETIES GROWN IN NEW ZEALAND.

R. A. Calder, Agronomy Division, Lincoln.

In New Zealand an area of approximately 13,000 acres is occupied annually by mangels. The provincial acreages for the 1935–36 season were:—

North Auckland	210	Marlborough	121
Auckland	524	Westland	4
Gisborne	196	Canterbury	4,304
Hawke's Bay	708	Otago	2,390
Taranaki	807	Southland	127
Wellington	3,732		
Nelson	87	Total	13,210

Although the total acreage is not large, the crop is well distributed; it is grown most extensively in Canterbury, Wellington, and Otago. In consideration of the fact that mangels are an excellent winter forage crop it would seem that a further increase is warranted.

Mangels prefer warm conditions and, for highest yields, a fertile soil. When well established they can withstand drought better than other root crops and suffer little handicap on account of disease. Yields of from 50 tons to 60 tons per acre are common over wide areas and the roots afford a palatable, wholesome, succulent forage for winter use.

Practically all the seed used is imported from England. There are numerous varieties which vary in behaviour as well as in appearance—*e.g.*, the long or semi-long types thrive best on soils which are rich and fertile, whereas for poorer conditions it is preferable to grow the intermediates, tankards, or globes.

In order to obtain some information concerning the characteristics of the different types, an investigation was commenced in the 1934–35 season. Distinct lines of different varieties were obtained from seed-merchants and grown at Palmerston North.

In comparing the different lines and in contrasting the different varieties, type observations were recorded, approximate yields were obtained, and sugar and dry-matter contents were determined.

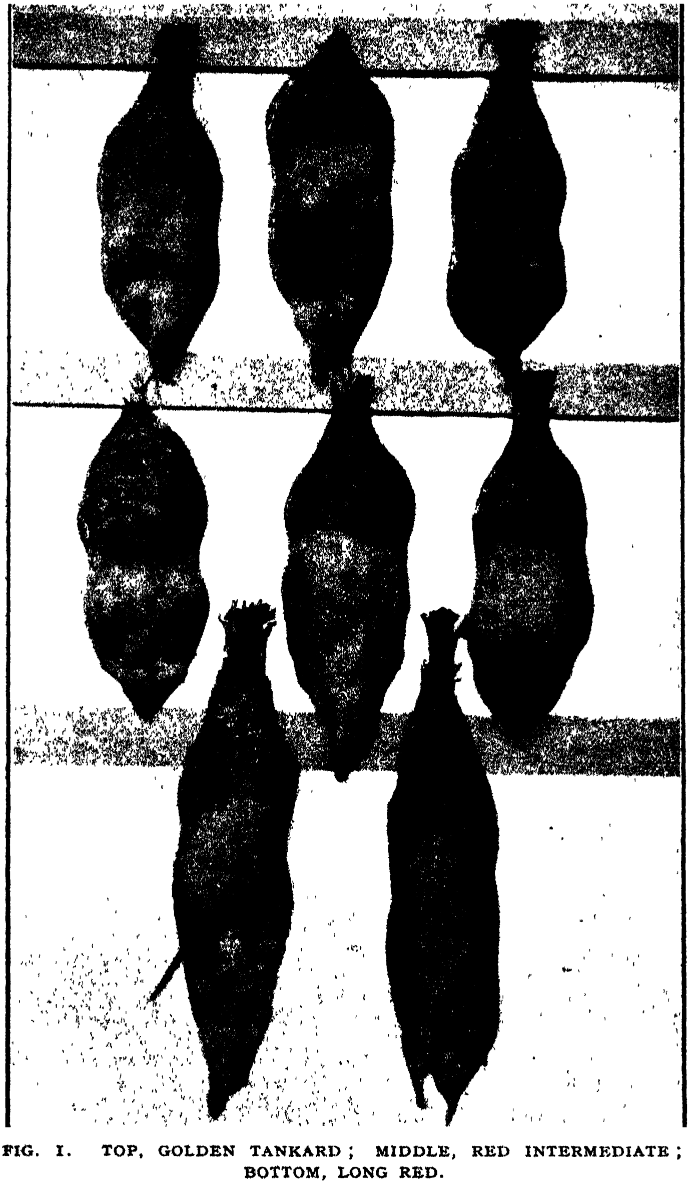


FIG. 1. TOP, GOLDEN TANKARD; MIDDLE, RED INTERMEDIATE; BOTTOM, LONG RED.

NOTE.—Root-size cannot be compared in the separate photographs.

TYPES OF MANGELS.

Mangel varieties may be grouped according to their shape, and the most convenient expression of this character is a length to breadth ratio. Table I shows a classification based on such determinations, and includes observations on skin and flesh colour.

Table I.—Classification of Varieties according to Shape, with a Description of Skin and Flesh-colour.

Class and Variety.	Skin-colour.	Flesh-colour.
Long (length/breadth, ratio 4 : 1)—		
Long Red (Fig. 1) ..	Bright red below ; duller red above	White, with uneven red bands or rings.
Semi-long (length/breadth, ratio 3·5 : 1)—		
Sugar 1 (Fig. 2) ..	Pale red or pink below ; dull pinkish-green above	Dominant white with darker bands ; a few with pink bands.
Sugar 2	White below ; drab green above	White.
Jersey Queen (Fig. 2) ..	Yellow or pale orange below ; bronze-green above	White, with darker bands.
Gatepost (Fig. 2) ..	Pale yellow below ; bronze-green above	White with, occasionally, greenish-yellow bands.
Dairyman (Fig. 2) ..	Pale yellow to light orange below ; pale bronze-green above	White, with darker bands, which are occasionally a very pale green
Intermediate (length/breadth, ratio 2·5 : 1)—		
Red Intermediate (Fig. 1)	Bright red below ; dull reddish-green above	White, with occasional uneven red bands.
Tankard (length/breadth, ratio 2·5 : 1)—		
Golden Tankard (Fig. 1)	Bright orange below ; drab, pale greenish-brown above	Whitish cream to yellow, with dark-yellow bands.
Semi-globe (length/breadth, ratio 2 : 1)—		
White Knight (Fig. 5) ..	Greenish or pale yellow below; drab, bronze-green above	White.
Globe (length/breadth, ratio 1·5 : 1)—		
Prizewinner (Fig. 3) ..	Yellow or yellow-brown below; bronze-green above	White, with faintly darker bands.
Yellow Globe (Fig. 3) ..	Yellow or yellow-brown below ; bronze-green above	White, with, occasionally, uneven yellow bands.
Orange Globe 1 (Fig. 4)	Dark orange below ; drab, light-brown above	Pale yellow, with dark-yellow or yellow-brown bands.
Orange Globe 2 (Fig. 4)	Medium to dark orange below ; drab, green-brown above	White, with darker bands occasionally tinged yellow.
Orange Globe 3 (Fig. 4)	Pale orange to yellow below ; drab, bronze-green above	Mainly white, with darker bands ; a few with yellowish bands.
Golden Standwell (Fig. 5)	Bright orange below ; drab, pale greenish-brown above	Whitish cream to yellow, with dark-yellow bands.
Lemon Globe (Fig. 3) ..	Cream or pale yellow below ; bronze-green above	White, with darker bands.
Quite Content (Fig. 5)	Pale pink to light red below ; greenish-pink above	White, with darker bands.

Two distinct types were received under the varietal name of " Sugar " mangel, and three under the name of " Orange Globe." The differences in each case, however, were not outside the limits of variation that might be expected to arise as a result of several firms selecting the same variety along individual lines. " Dairyman " and " Jersey Queen " proved to be very much alike, while " Prizewinner " and " Yellow Globe " appeared identical.

A characteristic of " Red Intermediate " and to a lesser extent of " Golden Tankard " was the incurving of the root at the middle resulting in a definite waist.

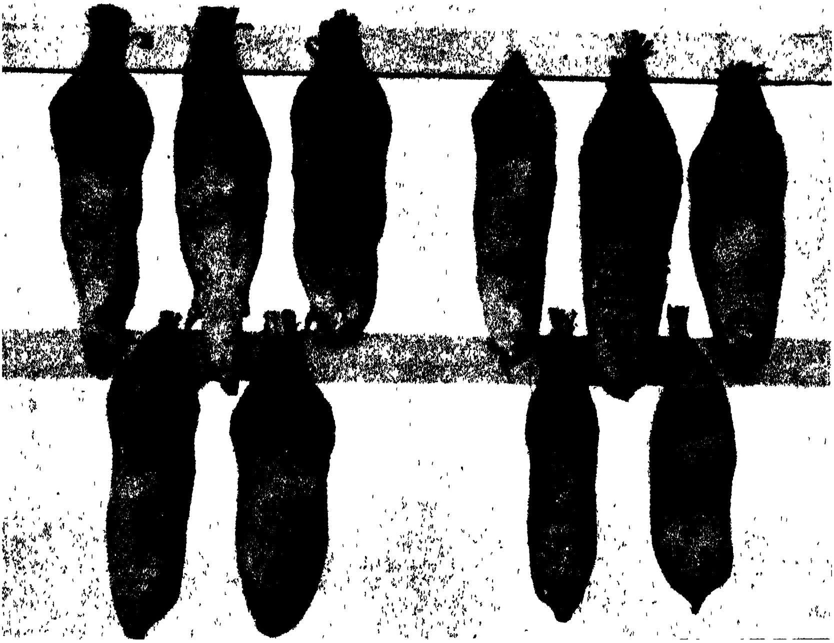


FIG. 2. TOP LEFT, RED SUGAR ; TOP RIGHT, JERSEY QUEEN ; BOTTOM LEFT, DAIRYMAN ; BOTTOM RIGHT, GATEPOST.

VARIETAL PURITY.

For most varieties there are a number of strains available. These, generally, are indistinguishable, though occasionally some are less satisfactory than others ; they may be of a poorer type or contain a higher percentage of rogues. Occasionally also they become incorrectly named. One of the purposes of the trial was to investigate this position.

The general standard of purity proved to be reasonably satisfactory. Four lines out of 45, or about 9 per cent., were incorrectly named, but the percentage of foreign varieties and off types within each line amounted to only about 1 per cent. Therefore, while the nomenclature of varieties may be a little at fault, the standard of purity is high. Observations were made on the incidence of disease ; very little was in evidence.

Records taken may be observed in Table II.

Table II indicates the number of lines of the different varieties which were received, the number incorrectly named, the degree of type purity, and the incidence of disease.

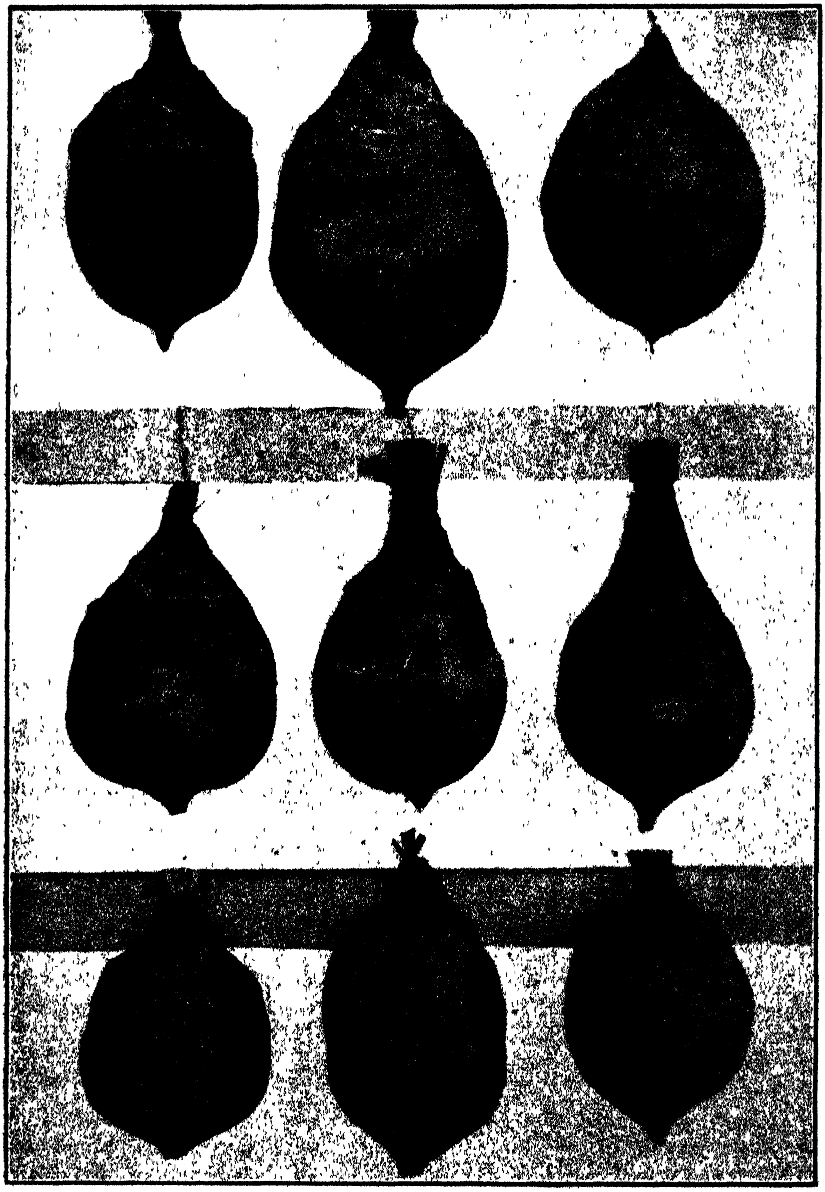


FIG. 3. TOP, YELLOW GLOBE; MIDDLE, PRIZEWINNER; BOTTOM, LEMON GLOBE.

Table II.

Variety.	Number of Lines sent in.	Number of Lines incorrectly named.	Average Per Cent. of Rogues and off Types.	Average Per Cent. of Diseased Roots.	Remarks.
Long Red ..	5	..	0·4	0·8	
Sugar (red) ..	3	..	0·7	1·4	Red Sugar mangel.
Sugar (white) ..	1	..	0·5	..	White Sugar mangel.
Jersey Queen ..	5	2	1·4	..	One line judged to be Golden Tankard; one line judged to be Yellow Globe.
Gatepost ..	2	1	5·5	..	One line judged to be Long Red.
Dairyman ..	1	..	..	..	Rather similar to Jersey Queen.
Red Intermediate	5	..	0·4	..	One line named Red Lion.
Golden Tankard	4	..	..	1·1	
White Knight ..	2	1	2·8	..	One line judged to be Golden Tankard.
Prizewinner ..	5	..	0·4	0·4	Similar to Yellow Globe
Yellow Globe ..	5	..	..	0·4	
Orange Globe 1 ..	1	..	..	..	Probably Golden Globe
Orange Globe 2 ..	1	..	..	..	
Orange Globe 3 ..	2	..	1·1	..	
Golden Standwell	1	..	..	..	
Lemon Globe ..	1	..	2·3	..	
Quite Content ..	1	..	..	..	
Total ..	45	4	..	..	

YIELD AND CHEMICAL ANALYSES.

The feeding-value of mangels depends upon their dry-matter content, of which sugar is the most important constituent. Varietal differences exist in regard both to yield and to composition, but as these qualities are influenced by environmental factors it is difficult to obtain representative averages.

An attempt was made, nevertheless, to determine the comparative values of a few varieties, based on yielding-ability and on dry-matter and sugar content. The results are offered in Table III, but as they have been obtained from an insufficient number of trials no strict reliance can be placed upon them.

Table III.—Yields and Analyses of Mangel Varieties.

Variety.	A. Yields, in Tons per Acre, 1934–35.	B. Yields in Tons per Acre, 1935–36.	Average of A and B.	Dry-matter Per Cent., 1935–36.	Dry-matter Yield, Tons Per Acre, 1935–36.	Sugar, Per Cent., 1935–36.	Sugar Yield, Tons Per Acre, 1935–36.	Average Weight of a Single Root, in Grains, 1935–36
Long Red	64·1	47·0	55·6	9·7	4·56	6·3	2·96	2,214
Sugar 1 (red) ..	68·1	37·5	52·8	13·2	4·95	8·0	3·00	1,941
Sugar 2 (green) ..	74·5	50·0	62·3	9·5	4·75	5·4	2·70	2,434
Jersey Queen ..	72·2	51·0	61·6	8·9	4·54	5·1	2·60	2,431
Red Intermediate ..	74·0	58·0	66·0	8·2	4·76	5·0	2·90	2,839
Golden Tankard ..	65·0	36·0	50·5	9·8	3·53	5·6	2·01	2,084
White Knight ..	75·7	55·5	65·6	8·4	4·66	4·9	2·72	3,324
Yellow Globe ..	68·8	60·0	64·4	8·1	4·86	5·3	3·18	2,741
Orange Globe (3) ..	73·3	72·0	72·6	7·2	5·18	4·1	2·95	2,931
Lemon Globe ..	84·7	66·5	75·6	7·7	5·12	4·2	2·79	3,437

Comments on Table III.

1. Yields in the 1934–35 season were obtained from plots grown at the Plant Research Area, Palmerston North. In the 1935–36 season the trial was repeated at Massey College, and representative samples were forwarded to the Dominion Analyst, Wellington, for analysis.

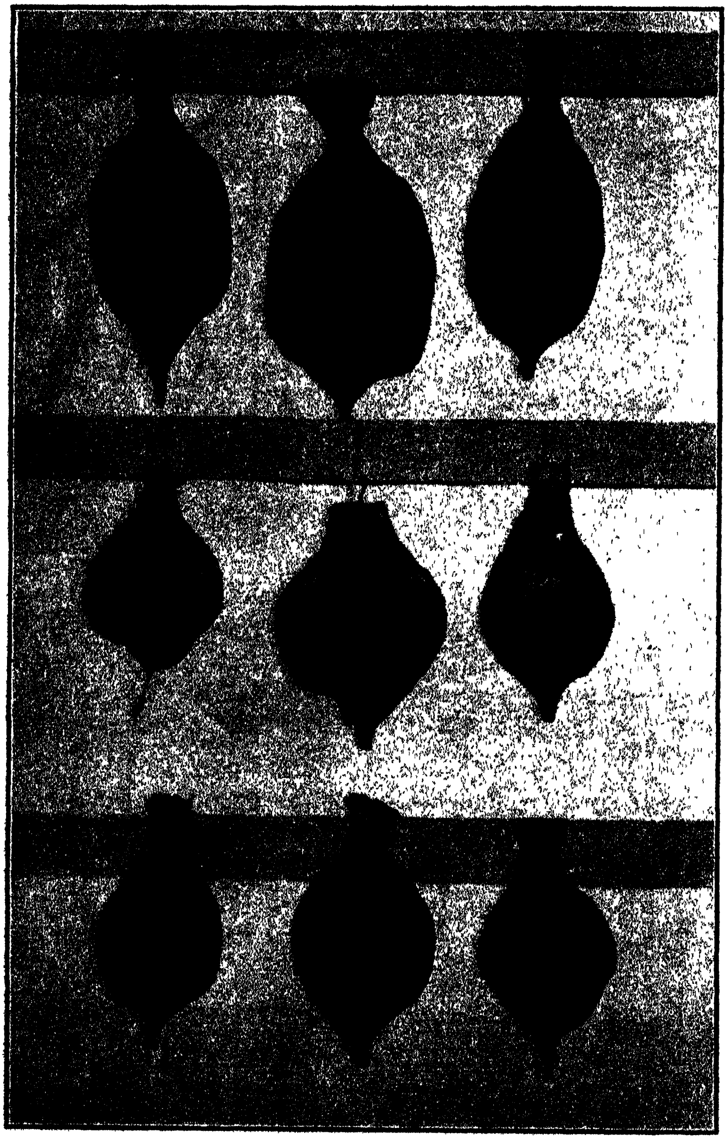


FIG. 4. TOP, ORANGE GLOBE 1; MIDDLE, ORANGE GLOBE 2; BOTTOM, ORANGE GLOBE 3.

2. With some exceptions, the following relationships between certain characteristics are indicated :—

(*a*) *Shape and Yield*.—The longer-shaped varieties tend to produce lower yields than the globe-shaped types.

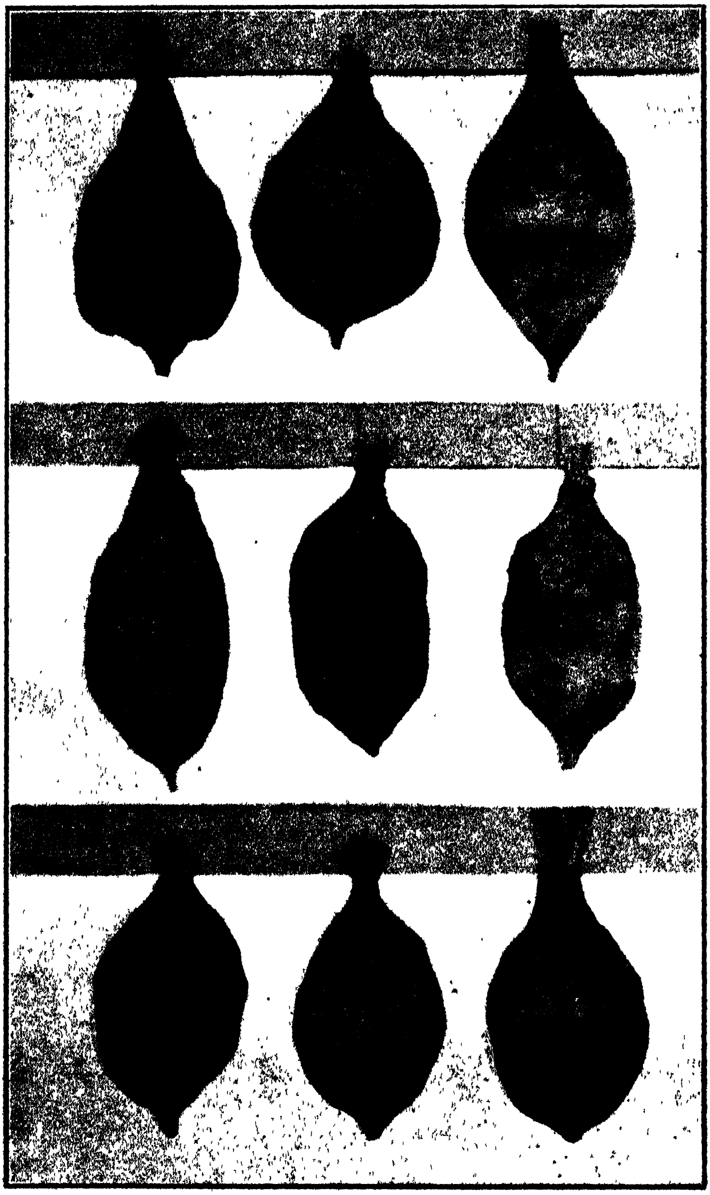


FIG. 5. TOP, QUITE CONTENT ; MIDDLE, WHITE KNIGHT ; BOTTOM, GOLDEN STANDWELL.

(*b*) *Yield and Quality.*—Types giving the heaviest yields are poorer in dry-matter and sugar content than those giving lower yields.

(*c*) *Size and Yield.*—The heaviest yields were obtained from those varieties with the largest individual roots.

(*d*) *Size and Quality.*—The larger roots tend to be poorer in dry-matter and sugar content than the smaller ones. The extra quality possessed by the Red Sugar mangel has in all probability been inherited from its sugar-beet parent.

3. If the yield per acre of dry matter or sugar can be regarded as a measure of the value of a variety then, with the exception of Golden Tankard, there is little to choose between any of those tested; in all probability none of the differences would be significant.

From these results it might be concluded that, from a theoretical point of view, there is little difference in the ultimate feeding-value of any of the varieties considered, Golden Tankard excepted. When viewed practically, though, distinctions can be made for, within certain limits, a variety providing a heavy crop of poor quality would not be such an efficient feeding unit as one giving a lower yield but of better quality.

In connection with these results, the observations of Professor Boving, University of British Colombia, Vancouver, Canada, are of interest. He states: "In no case during thirty years of comparative tests has the Long Red mangel been able to compare in total yield or in feeding value with good varieties of the intermediate or ovoid types. The probable reason why, nevertheless, it has survived in practice is that it was the first mangel to be listed in a seedsman's catalogue." He mentions that the Globes are poorer in dry matter than the intermediates, and continues, "but they (the Globes) may be recommended, nevertheless, where mangels are grown entirely as a conditioner and where the feeding value is of less importance than succulence. Cylindrical mangels are reasonably good total yielders, but they are low in production of dry matter per acre. The Red Sugar mangel cannot compete with the intermediate or ovoid in yield, but, as it is a very good keeper, and, as the composition of its dry matter has a particularly good effect in pig and poultry feeding, it is well worth growing on a limited scale."

These conclusions are not so widely different from those offered above, with the exception that, from the Palmerston North results, the Long Red mangel could not be so severely condemned.

LOSS IN WEIGHT DURING PITTING.

Mangels are generally pitted for some months before feeding. During this period changes take place in the chemical composition of the roots and there is a decrease in weight due, mainly, to the loss of moisture.

Twenty representative roots of the more commonly grown varieties were weighed on pulling and pitted under straw; care was taken to subject each variety to the same conditions. At the end of three months they were again weighed.

The loss of weight during the period of storage is recorded in Table IV. It will be seen that the average loss is about 14 per cent., with a range from 11 per cent. to 17·4 per cent. according to variety.

Loss of weight during pitting must, however, vary considerably according to the method adopted, and the relative loss of an individual root will depend upon the position it occupies in the pit.

Such a trial as this would have to be repeated for several seasons and under varying conditions of pitting before a reliable average could be indicated.

Table IV shows loss of weight, during storage, for some of the more important commercial varieties.

Table IV.

Variety.	Weight in Pounds, of Twenty Roots prior to Pitting, 23rd June, 1936.	Weight, in Pounds, of same Twenty Roots after Pitting, 2nd September, 1936.	Actual Loss, in Pounds.	Percentage Loss.
Long Red	126·0	107·0	19·0	15·1
Sugar 1	111·4	92·0	19·4	17·4
Sugar 2	125·2	109·5	15·7	12·5
Jersey Queen	128·3	112·4	15·9	12·4
Red Intermediate ..	137·4	120·0	17·4	12·7
Golden Tankard ..	111·2	93·5	17·7	15·9
White Knight	168·2	146·2	22·0	13·1
Yellow Globe	151·0	128·8	22·2	14·7
Orange Globe . ..	169·5	150·8	18·7	11·0
Lemon Globe	153·5	133·2	20·3	13·2

SUMMARY.

1. The mangel varieties commonly grown in New Zealand have been grouped according to shape; skin and flesh colour has been described.

2. A number of lines of each of the varieties were received. These were examined to determine the percentage incorrectly named, the degree of type purity and the incidence of disease.

3. An attempt was made to evaluate the varieties based on total yield and on dry-matter and sugar content.

4. Approximate figures for the loss of weight during storage were obtained.

ACKNOWLEDGMENTS.

This work was supervised by Mr. J. W. Hadfield, Director, Agronomy Division. The yield trials at Massey College were carried out under the direction of the ex Dairy-farm Manager, Mr. S. McGuiness, the analyses were determined by the Dominion Analyst, Wellington, and the photographs were taken by Mr. H. Drake.

SEASONAL NOTES.

THE FARM.

Special Measures regarding Winter Feed.

AN outstanding feature of the present farming position throughout most of New Zealand is the prospective abnormally large shortage in reserves of feed for use in the winter and early spring of next year. The normal provision of feed for this critical period is substantially less than sufficient to meet the economic needs of stock—a fact which often is well demonstrated when comparisons are made between the returns of farms of an average standard of winter feeding and those of farms on which the winter feeding is appreciably better than the average. As the provision of reserves for the coming winter promises to be poorer than the normal one, which is harmfully scant, an acute position is likely to arise unless all possible remedial steps are taken. Frequently in January there is still time to make additional provision.

If favourable weather is experienced in time to allow of the preparatory cultivation which is advisable, a valuable measure is the sowing of temporary pasture, in the late summer or early autumn, on ground which, if not already broken out of grass would soon be so. A temporary mixture generally useful is to be expected from the sowing of 25 lb. to 30 lb. of Italian rye-grass and 6 lb. of red clover an acre. To ensure that temporary pastures provide a substantial amount of winter feed they must be sown early, and they generally can be depended upon for a heavy crop of hay in the next summer. If the temporary pasture is likely to have a life of less than a year and quick production of feed is especially desirable, then half of the Italian rye-grass may be replaced usefully by an equal amount of seed of Western Wolths rye-grass.

When the land to be used for late summer or autumn sowing is to be sown in spring in another crop it is likely to prove advisable to grow a fall-sown green-cereal catch-crop such as oats or barley, both of which usually give good results when sown at the rate of about 2½ bushels an acre. Such catch-crops, which under favourable circumstances give considerable feed in winter and early spring, may be followed by root or other suitable crops in the spring. Catch-crops after turnips or another cereal crop at times give quite good results when sown after relatively a very small amount of preparatory cultivation. Disking at times gives sufficient tilth for the seed-bed required. With such crops a dressing of superphosphate usually is profitable ; as a rule 1 cwt. an acre may advantageously be used in districts of somewhat low rainfall, while 2 cwt. an acre may be well worth while in districts of good rainfall, if the response to phosphates is known to be high, and it frequently is. Such dressings of superphosphate as a rule increase not only the yield but also the rate of growth.

Often the fullest possible yields are not obtained from temporary pastures or cereals sown for winter feed because the crops are sown too late. This applies particularly in the South Island. Further, the likelihood of success with such crops is lessened if there has not been thorough preparatory cultivation. To give the mellow condition of the soil that results from aeration and weathering, if possible a month should elapse between the initial preparatory cultivation and the sowing. Against this is to be set the fact that the date of sowing is a critical matter ; crops sown in January or February as a rule are much better for winter feed than ones sown in March, while crops sown in March may be expected to be appreciably superior to ones sown later.

Conclusive information about the varieties of cereals commonly used for green-feed purposes seems not to be available, but the following facts yield some guidance: Algerian oats, on the basis of field experience, has for many years continued decidedly popular; black skinless barley excels in the quick production of green-feed, but is likely to be otherwise inferior to Algerian oats Cape barley also is marked by quick production of green-feed, but its tendency to become stemmy in late winter and early spring is a definite weakness in respect to the production of green-feed at that period.

General Cropping Work.

When the sowing of turnips and swedes has not been completed by the end of December, as a rule it should be carried out as speedily as possible. In most places after the middle of January it is better to sow turnips than swedes: turnips not only develop more quickly than swedes, but also suffer less from insect pests, which at times, and particularly in dry seasons, cause severe damage in late summer and autumn. Hardy Green Globe turnips are suitable for January sowing. Both turnips and swedes usually respond quite profitably to a dressing of fertilizer in which superphosphate is prominent.

Although generally the sowing of lucerne in November or December is preferable, it sometimes may be carried out with good results after mid-summer, but this, judging from field experience, is true only of districts in which the winter growth of plants in general is small. In districts characterized by mild winters, fall sowing of lucerne generally though not quite always has given unsatisfactory results, in such districts the cold of winter suffices to make lucerne dormant, but plants invading the lucerne, including rye-grass and common weeds, make enough growth through the winter to outgrow the lucerne-seedlings sufficiently to deprive them of the direct sunlight which is vital to them and without which they cannot compete successfully with the invading plants If it is expected that there will be sufficient soil-moisture to allow of superphosphate exerting its fertilizing influence, then it is usually good practice to top-dress established lucerne about mid-summer with superphosphate just after it has been mown.

As a rule potatoes call for considerable work at this season. They should be kept free from weeds by suitable cultivation; possibly they should be sprayed preferably at such a date that the spraying will serve to prevent the establishment of blight in the crop rather than to check the spread of blight that has become established. Nevertheless, this latter benefit is often a very useful result of spraying which is likely to be not only more effective but also cheaper when the spraying-material used has been prepared suitably on the farm instead of purchased in a ready-made form. It is important to bear in mind that incorrect procedure in any particular may lead either to damage to the crop or to failure to control the blight. Full particulars about the preparation and application of sprays may be obtained from district officers of the Fields Division. At this season many potato crops will need to be moulded up. In districts in which the crops are likely to be subject to attacks of the potato-moth, moulding-up should be carried out with particular thoroughness as well-covered tubers are likely to escape damage by the moths.

As a rule the thinning of such crops as mangels and carrots should be carried out at this season—the Guerande carrot, because of its habit of growth normally does not need thinning. Any considerable delay in carrying out the thinning after the seedlings have become large enough to handle conveniently may bring about readily the permanent stunting of the plants.

In any year in which the supply of moisture in the soil is below what is needed to enable crops to make the greatest possible amount of growth, the summer tillage of crops which permit of it—*e.g.*, potatoes, mangels, &c.—is of paramount importance. A common cause of yields of crops being greatly below the yields that otherwise would be obtained is an inadequate supply of moisture in the soil in summer. Surface tillage is of marked value as a means of checking loss of soil-moisture. Further, suitable tillage brings about aeration which leads to improved fertility. To farmers in general a splendid object-lesson in the value of summer tillage commonly is given by Asiatic market-gardeners in the Dominion, who so often may be seen diligently tilling their crops in summer even though weeds are not in evidence—a procedure which even in arid districts or seasons regularly gives them good crops.

Preparation for New Pastures.

One of the tasks of basic importance to be faced by many farmers during the next few months is the sowing of new pastures, which often clearly does not receive as much thought as it warrants. A vital aspect of the position is that many persevere with inferior pastures when the most profitable course would be to put such poorly productive grassland under cultivation with the ultimate objective of resowing to obtain a new, superior pasture in the establishment of which it would be possible to use the superior strains of rye-grass, clover, &c., which have been introduced to commerce during fairly recent years, and which enable high-class pastures of a permanent character to be obtained.

Really poor results in the establishment of pastures are far from uncommon. It is of much practical importance to bear in mind at this season that such poor results are generally due to one or more of the following causes: (1) Sowing on a poorly prepared seed-bed; (2) sowing at an unsuitable time of the year; (3) use of unsuitable seed. In the case of pastures sown in the fall of the year both sowing on a poorly prepared seed-bed and sowing at an unsuitable time of the year usually may be traced to starting preparatory cultivation at too late a date. Full success in the sowing of permanent pastures may be expected only when the seed-bed is in a fine firm condition: the use of loose lumpy seed-beds is certainly courting failure, which though it is unlikely to be complete, is very likely to be particularly costly in its influence on the returns over a series of years. For instance, loose lumpy seed-beds quite often are linked with failures of clovers, a poor development of which is not consistent with a vigorous highly nutritious and highly palatable pasture. To secure a desirable seed-bed the cultivation of land to be sown in permanent pasture in the fall now should be kept in mind. A short preparation of the seed-bed does not allow of the natural weathering of the soil which field practice has shown to play a valuable role in the economical production of a fine, firm seed-bed. If preparatory cultivation is not commenced early enough, a ready alternative to sowing on a poorly prepared seed-bed at the right time is sowing later on a well-prepared seed-bed. Fairly often the date of sowing of pastures in the autumn is too late. In many parts some danger attaches to sowing later than March. Undoubtedly sowings made later than March at times are quite successful, but in many districts in the majority of seasons such late sowings cannot be depended upon for good results. It seems to be widely known that clovers are likely to suffer in late sowings, but it probably is not so generally realized that the development of rye-grass and other plants is at times subject to such great checks as the result of late sowings that it becomes doubtful whether the new pasture ever attains the level of production that a suitably early sowing would give: apart from any damage by the clovers slow development of pasture-seedlings may readily give weeds a greater foothold than they could gain during the quicker development that early sowing with its greater soil-warmth brings about.

If pasture is to follow an arable crop it may quite well be sound practice, provided the land is reasonably clean, to disk rather than to plough: the firmness of the seed-bed given by the disking may be an advantage, and in disking any fertilizing-matter provided by animal manure is kept near the surface where it is of most ready and effective benefit to the young pasture-plants. The value of firmness in the seed-beds for pastures is often demonstrated in the form of unusually good " strikes " where there has been exceptional consolidation—*e.g.*, in hoof-marks or in wheel-tracks or along headlands. Apart from the fact that firmness in the seed-bed seems to lead to vigorous root-development in pasture-plants, it is of major importance that there is less likelihood of seeds being covered too deeply in firm seed-beds : many of the pasture-seeds are so small that they can establish successfully only when lightly covered.

Top-dressing of Mown Grassland.

In those many districts which enjoy reasonably good summer rains and which have soils that ordinarily respond profitably to phosphates, an immediate and marked benefit may be expected from top-dressing with superphosphate any pastures from which hay or silage has been saved this year, unless such pastures recently have been top-dressed fairly liberally : it is usually preferable to apply the superphosphate as soon as the mown material has been removed. When pastures were mown at a leafy stage of development more vigorous aftermaths may be expected than from similar pastures mown at a later somewhat stemmy stage But the aftermath while valuable as a source of leafy feed when such feed is likely to be in inadequate supply, especially on dairy-farms, is not always the sole immediate benefit of top-dressing in the way described : pastures mown at an over-mature stage may be somewhat weakened, and so may benefit greatly from the strengthening influence of the top-dressing.

Utilization of Special Summer Feed.

In dairying, any feed specially grown to supplement the pastures in summer should be fed as soon as the production of butterfat commences to drop at a rate greater than production drops in well-fed cows of reasonably good dairy character. When the yield of a herd is falling off at such a rate that the decrease in production in a month is about 9 per cent. of the yield of the previous month, then the rate of the decline in production may be looked upon as approximately normal—*e.g.*, a herd averaging 30 lb. of butterfat in a particular month may be expected to average 27·3 lb. in the following month if it is of satisfactory dairy type and efficiently fed.

As far as practicable young stock, such as calves, should receive feed supplying liberal amounts of the substances required for the formation of bone and muscular as distinct from fatty tissue. Stemmy pastures are deficient in such substances, and if young growing stock are forced to subsist mainly on feed from such pastures permanent stunting of the stock may result.

—*R. P. Connell, Land Utilization Officer*

THE ORCHARD.

Cultivation and Cover Crops.

As the harvesting-season approaches growers may be considering easing up in the cultivation of the orchard. This may be advisable from some points of view, but before it is applied the soil should be brought to a good tilth. Even then a few strokes with the harrows, especially after summer showers, will prove beneficial, as this will help to retain the moisture already conserved in the soil. All trees in the orchard should be thoroughly hoed round, as this will destroy many of the breeding-places for pests and diseases. If the soil is left in good condition before cultivation ceases, the preparation of the land for the sowing of a green-crop early in January will be simplified. Blue lupin has been, and probably still is, the most favoured green-crop for the orchard, although some growers, under the impression that their soil is " lupin-sick " after a few years of this crop, are reverting to oats and vetches, which is another good green-crop for the orchard. Climatic conditions in different districts have a bearing on the appropriate time for sowing a green-crop; but, if lupins are decided on, early January will generally be found the most suitable time for sowing. This will give plenty of time for the plants to grow and mature before ploughing under in the late autumn or early winter. Green-cropping is strongly advised where the soil is deficient in humus. Not only does a well-grown crop of lupins supply a large quantity of humus to the soil, but it is a means of adding nitrogen, so valuable in maintaining the general health of the tree. An application of superphosphate at the rate of from 1 cwt. to 1½ cwt. per acre is recommended when sowing the crop.

Thinning the Crop.

The natural drop of all varieties of fruit will be finished by the time these notes appear, and growers are reminded that, where only one thinning has been done, it may be necessary to go over the trees again, removing any fruits that are misshapen, diseased, or badly russeted, &c. This will allow the remaining fruits to develop properly, and thus reduce the quantity of small fruit to a minimum. It will also assist in the production of regular crops each year. All clustered fruit should be, in the majority of cases, reduced to two or three, and where heavy crops have set it often pays to reduce the bunches to individual fruits.

Pest and Disease Control.

The continuation of spraying, as recommended in previous notes in the *Journal*, should be attended to. Up to the present time growers have been favoured with a good spraying-season, and because of this some are apt to relax their efforts, with the result that pests and diseases become established. Reports from different fruit areas of the Dominion indicate that with the dry weather now being experienced red mite is on the increase. All growers are well aware of the great amount of injury that can be done by this pest, and every endeavour should be made to control it before the over-wintering eggs are deposited. By impairing the condition of the foliage, and thus reducing its functioning-powers, this pest can reduce the vitality of the tree to such an extent that the current season's crop will be seriously affected and buds for the following season considerably weakened. Although the regular applications of lime-sulphur should do much to keep this pest in check, if infection becomes serious it will be necessary to apply nicotine-sulphate, 40 per cent., at strength 1–800, either in combination with the sulphur sprays or alone. If used alone, the addition of soft-soap at the rate of 4 lb. per 100 gallons of spray is necessary to act as a spreader and sticker and increase the effectiveness of the spray.

Green aphis has become very troublesome on stone-fruits this season, possibly on account of the dry, warm conditions. Growers are advised to apply nicotine-sulphate (1–800) for its control. Usually one thorough application is sufficient; but it is advisable to give an extra spray six or seven days later in order to catch any of the aphis missed in the first spray. Stone-fruits should also receive regular applications of lime-sulphur at strength 1–180 for the prevention of brown-rot, leaf-rust, &c. The addition of 2 lb. of colloidal sulphur per 100 gallons will be found beneficial. These sprayings should be continued up to three weeks before harvesting the crop.

As the leaf-roller caterpillar is responsible for much damage to both foliage and fruit, especially where the thinning of fruit has not been sufficient to separate the clusters, a close watch should be kept for any signs of this pest, and lead-arsenate spray applied before the caterpillar has an opportunity of rolling the leaf. Once inside the rolled-up leaf it is almost impossible for the spray to reach the caterpillar.

Handling the Crop.

Early varieties of stone-fruits will be ready for harvesting during the month, and growers should see that everything connected with the handling of the fruit is ready, so that no time will be lost when picking commences. Stone-fruits require handling with the greatest care: they bruise easily, and any skin punctures may result in the entry of brown-rot. Fruit which has to travel any distance should be picked when firm. Proper grading is essential if the best prices are to be obtained. Only fruit of the same size, and the same degree of maturity, should be packed in the case. Pack the fruit carefully into clean cases and make it as attractive to the buyer as possible. Repeat orders are usually the result of quality combined with attractiveness.

The picking and packing of pip-fruits both for export and the local market will soon be under way, and growers will have very little time to spare for other matters. All fruit-cases should be made up and stacked in a convenient place; cases for export should be labelled; corrugated and wrapping paper placed in a handy position for the packers; rubber stamps and stencils should receive attention; in fact, everything done to ensure smooth working all through the harvesting-period. Another reminder is given to growers to thoroughly clean out the packing-shed, destroy old and dirty picking-cases and spray the whole with a solution of bluestone as recommended in the October notes. Reject fruit should not be allowed to lie in and around the packing-shed, but either given to the pigs or destroyed as soon as possible. In the orchard the necessity for care in handling a perishable article should be fully appreciated. Fruit for the local market should be allowed to remain on the trees longer than fruit intended for export to enable it to reach that stage of maturity most acceptable to the buyers.

—*George Stratford, Orchard Instructor, Motueka.*

Citrus Culture.

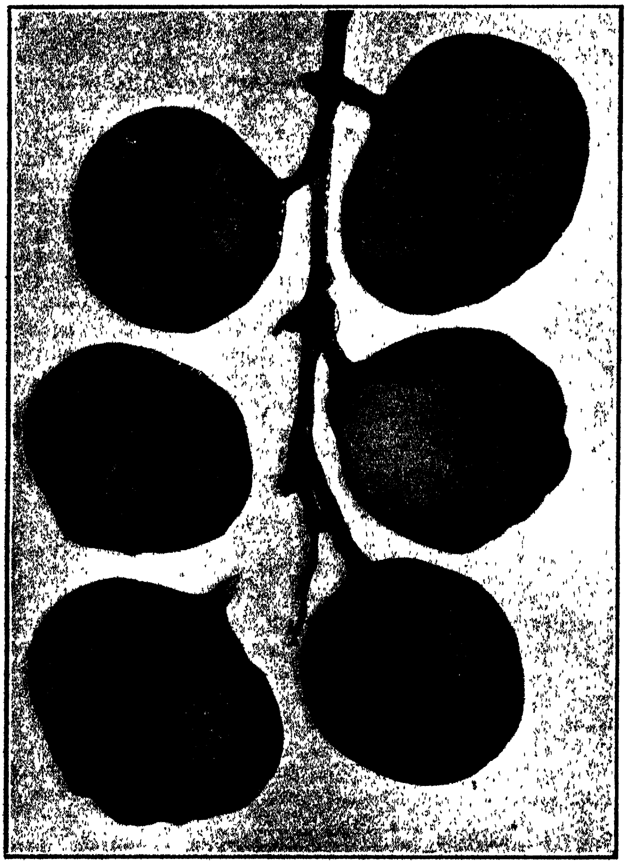
Citrus Thrips.—Characteristic symptoms of thrip infection on citrus trees is a silvering of the foliage—particularly the underside—and portions of the fruit. The appearance of injury caused to fruit early in the season changes as the season advances into rough scurfy areas. In cases of severe infection these areas will at times cover the greater portion of the fruit. Such blemishes lower the market value of the fruit appreciably and the injury to the foliage checks the general vigour of the trees. Long periods of low rainfall accompanied by high temperatures when occurring between January and May usually result in the rapid spread of the pest. Mandarin and orange trees are generally affected much more severely than lemon trees.

As mentioned in these notes for the previous month, control measures applied at the blossoming period are of doubtful value. In most seasons thrips cause no great amount of damage until late in January or later, consequently a close watch for infection should be kept at this period. Good control can be obtained by spraying at four-weekly intervals during the late summer and autumn with lime-sulphur (15 per cent. polysulphide content at a dilution of 1–45. It is important that the spraying should be done thoroughly, care being taken to direct the spray towards the underside of the foliage. Orange and mandarin trees in particular should be thinned by pruning where necessary to ensure the spray reaching all portions of the tree.

New Plantings.—If a prolonged spell of dry weather is experienced it may be necessary to water trees that were planted in the spring. In such cases sufficient water should be used at each application to allow of penetration to the deepest roots. Frequent light waterings are to be avoided as this practice tends to keep the soil cold and brings the rootlets too near to the soil surface.

Shoots arising from the trunks should be rubbed off as they appear and straggling shoot growth should be pinched back to enable the tree to develop a balanced head. Frequent attention to such matters in young trees often prevents the need for cutting out large limbs in later years.

Bud Selection.—Many orange and lemon trees in established orchards are consistently producing fruit of an inferior type, and these should be worked over with as little delay as possible with buds carefully selected from trees producing the best strain of the varieties to be worked. The Orchard Instructor for the district in which you are located will be pleased to advise you in connection with this matter and where suitable bud-wood may be obtained.



INFERIOR TYPE OF EUREKA LEMON.

Trees producing such fruit should be worked over with buds taken from outstanding trees.

Insect Pests.—It is of the utmost importance that red scale (*Chrysomphalus aurantii*) infection should be reduced to an absolute minimum as early as possible. The scale not only causes tree debilitation, but it necessitates the scrubbing of infected fruits, which often results in injury to the skin, and subsequently in a high percentage of mould infection during the curing and marketing period. To ensure a satisfactory control by spraying with summer-oil, as recommended in these notes for the past month, it is essential that the trees should be sufficiently open to permit of the spray penetrating to every part of the surface of the trees. Trees which are excessively dense in the heads should be thinned by pruning before the spray is applied. Special attention, in spraying for red scale, should be given to the uppermost and lower branches since these portions of the tree are most likely to be missed by the spray.

—*P. Everett, Orchard Instructor, Gisborne.*

POULTRY-KEEPING.

Feeding—*continued.*

In last month's notes a popular method of feeding was given. The following are other rations which the writer has seen fed with success:—

No. 1.

Pollard	2 measures ..	Mixed with water.
Bran	1 measure ..	
Meat-meal ..	7½ per cent. ..	
Oyster-shell dust ..	1 per cent. ..	
Cod-liver oil ..	1 per cent. ..	
Chaffed greens ..	20 per cent. ..	

A light scratch feed of oats at noon, and wheat at night—about 1½ oz. per bird

No. 2.

Pollard	8 measures ..	Mixed with water.
Bran	4 measures ..	
Oat pollard ..	1 measure ..	
Meat-meal ..	7½ to 10 per cent.	

Green food at noon, and a good feed of wheat at night.

No 3.

Bran	8 measures ..	The salt was dissolved in the water with which the mash was mixed.
Wheat-meal ..	4 measures ..	
Meat-meal ..	1½ measures ..	
Salt	½ per cent. ..	

Equal parts of wheat, cracked maize, barley, and oats at night; green food after last feed at night.

No. 4.

Pollard	2 to 3 measures	Mixed with skim-milk; meat-meal was always before the birds.
Bran	1 measure ..	
Meat-meal ..	5 per cent. ..	

Green food at noon; grain at night, consisting of 3 measures of wheat and 1 each of barley and cracked maize.

Where birds were kept on the intensive system—that is, they were never out of the houses—the following rations were fed:—

No. 1.

Bran	4 measures ..	Half a measure of skim-milk powder was dissolved in the water with which the mash was mixed.
Oat pollard ..	1 measure ..	
Wheat-meal ..	1 measure ..	
Pea-meal ..	⅓ measure ..	
Meat-meal ..	¾ measure ..	

Wheat was fed at night, and chaffed green food given after the wheat.

No. 2.

Pollard	11 measures	The whole was mixed with skim-milk and as much given as the birds could clean up in about an hour.
Bran	4 measures	
Ground oats	1½ measures	
Wheat-meal	1½ measures	
Meat-meal	1 measure	
Chaffed greens	6 measures	

Wheat was fed at night—about 1½ oz. per bird.

Dry-feed mixtures, which were fed in hoppers and left before the birds for most of the day, were as follows :—

No. 1.

Pollard	100 lb.	Linseed-meal	3 lb.
Bran	30 lb.	Wheat-meal	15 lb.
Meat-meal	15 lb.	Salt	1 lb.

First thing in the morning the birds were given 1½ oz. each of wheat, and the same amount was given at night ; green food at noon.

No. 2.

Maize-meal	50 lb.	Skim-milk powder	4 lb.
Bran	16 lb.	Bone-flour	2 lb.
Pollard	16 lb.	Linseed-meal	4 lb.
Meat-meal	4 lb.	Salt	½ lb.

A light scratch feed of oats at noon ; wheat at night, and green food after the evening meal.

At one of our egg-laying tests where good results have been obtained the following is the system of feeding : A mash is fed in the morning, made up of 3 measures of pollard and 1 measure of bran. This is mixed to a crumbly state with liver soup. As much is given as the birds will clean up in half an hour. After feeding, the pens are inspected, and if some birds require more it is given to them. At noon a small quantity of boiled liver is given to each bird. Green food is also given, and on hot days extra green food is fed. At night a grain mixture made up of 3 measures of wheat and 1 of cracked maize is fed, and a 2-oz.-tobacco-tinful is given to each bird. Oyster-shell and metal grit are always before the birds.

At another large test a mash is fed in the morning, made up of 3½ measures of pollard, 1 of bran, 1 of chaffed green food, and ½ measure of ground oats, the whole moistened with skim-milk, and as much given as the birds will clean up. From the beginning of April about 5 per cent. of meat-meal is added, and is gradually increased up to 7½ per cent. About August this is gradually reduced, and from September until December only skim-milk is used as animal food, then meat-meal is again gradually added.

At noon chaffed green food is fed, and in the evening grain, consisting of 4 parts of wheat and 1 of oats. Oyster-shell grit and clean water are always before the birds.

Feeding-systems.

It may be said that there are two main systems of feeding, known as the moist- and the dry-mash systems.

The most popular system is to feed a moist mash in the morning and grain at night. However, as previously stated, experience has shown that it makes little or no difference whether the mash is fed in the morning or in the evening. It is really a matter of which is the most convenient for the poultry-keeper.

The other system is to feed a mixture of meals in a dry state, and place the mixture in hoppers so that the birds can please themselves. The chief advantage of the dry-mash system is that it reduces labour, and is especially suitable for the poultry-keeper who has to leave for work early in the morning, and who has not the time to prepare a moist mash. It is a system that could be used to advantage on a general farm where the farmer and his wife are usually so busy first thing in the morning that often the fowls do not get fed until after the children go off to school.

Experience would indicate that better egg-returns are usually obtained when both moist and dry mashes are fed.

Some poultry-keepers claim that the dry mash encourages rats and is a more expensive system, and for these reasons, after a lengthy trial, they have gone back to the moist-mash method, while others still like the dry-mash method. Success depends largely upon attention to detail. When feeding dry mash it is advisable to see that ample feeding-space is provided for all birds at the hoppers, and also that more or less equal amounts of dry mash and grain are consumed. If too much mash and not sufficient grain is eaten, it is a good plan to close up the dry-mash hoppers for a couple of hours each day before feeding the grain.

The Art of Feeding.

The art of feeding is largely a question of common-sense and judgment. A few minutes devoted to watching the birds at feeding-time is time well spent It is not advisable to rush through the pens, as some birds are highly-strung, nervy, and easily upset; in fact, as a rule the finer-bred a flock is the more highly-strung the birds are likely to be, and it is a great advantage to ensure that your birds have confidence in you.

Again, it is a good rule to feed according to appetite, and, as birds' appetites vary at times according to the weather, and especially when they are laying heavily or taking a rest, a little study of the birds while feeding will enable the beginner to feed more correctly.

Another point to remember is that it is really a waste to feed good expensive food and then compel birds to roost for long nights in damp, poorly-ventilated, or overcrowded houses. Healthy environment during hours of rest is a very important matter, for it is at that time that vitality is at a low ebb.

Regularity in Feeding.

Irregular feeding means irregular returns Fowls are creatures of habit, and contentment is a big factor in good digestion, so care should be taken to see that feeding is carried out at regular times. If birds have to hang around the gate waiting to be fed, they get discontented and lose confidence in their owner. Where the poultry-keeper is unable owing to the nature of his work to feed at regular times, he would be wise to try the hopper method of feeding, but if he is irregular through being naturally unpunctual he would be well advised not to take up poultry-keeping as a means of a livelihood, because punctuality is one of the essentials to successful poultry-keeping.

A very important item is water. Nothing will check egg-production quicker than an irregular water-supply, and this is not difficult to account for when it is remembered that one dozen new-laid eggs contain just on one pound of water, and science tells us that 50 per cent. of a bird's live-weight, together with the food she eats, is made up of water. An experiment carried out at the Wallaceville Poultry Station showed that forty White Leghorn pullets when only a few were laying, consumed 3 quarts of water a day, but when they were all laying they consumed 6 quarts 3 ounces of water in a day. These points go to show how very essential a good, constant water-supply is for regular egg-production.

Exercise Important.

Vigour is likely to deteriorate if birds do not get sufficient physical exercise. The functions of the various organs are kept in good working-order by encouraging, or may it be said, forcing the fowls to take plenty of exercise. The best way to do this, especially when they are kept on the intensive system, is to feed all grain in deep litter. Judgment is required to see that the litter is in good supply and dry. If the sheds are at all overcrowded or poorly ventilated, it is almost impossible to keep the litter dry. The floor of the house should be at least a few inches higher than the surrounding ground, and between 4 and 5 square feet floor-space should be allowed each bird.

The objective should be to encourage the layers to eat as much as possible, so the mash should be palatable, and all feed-troughs, &c., kept clean and sweet.

If a change has to be made, it should be made gradually.

—*C. J. C. Cussen, Chief Poultry Instructor, Wellington.*

THE APIARY.

Returning Swarms to Parent Hives.

SWARMS in January are of little value except as increase for the next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the hive is cramped an extra super may be given, and with this inducement the colony will usually settle down at once to work.

After-swarms should always be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin queen or queens can easily be picked out as they attempt to force their way through, and once these are removed the bees will return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frames, when she will be accepted by the bees.

Ventilation.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air day and night. All weeds and other obstructions should be removed from the fronts of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should the bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colonies.

Efficient use of Supers.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen will allow his bees to loaf or cluster outside the hives for lack of storage room. It is well when adding extra supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should be understood, however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work in the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not as yet hatched—it is an excellent plan to tier up with half-stories. Many an apiarist has had a moderate return from a small colony with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

Queen-excluders.

January is the month when queen-excluders are of most use, especially in southern districts. Whatever their disadvantage may be in some localities, in the south they have proved their efficacy in enabling extracting to be finished before the hot weather goes, without the destruction of any brood whatever. Excluders should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and, with nectar in abundance to be had all around them, they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queens confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens the queen-cells should be destroyed, as the queens which would emerge from them would not be able to pass through the excluders to get mated, and would in time develop into drone-layers. By providing the queen with plenty of empty combs she will be able to cultivate laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Excluders are often condemned as being productive of over-swarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

Foul-brood and its Treatment.

Foul-brood, unfortunately, is all too common in some localities, and in consequence beekeepers may at any time have a visitation. No one, however, should look upon foul-brood as a necessary evil: it can be cured. It is unknown in some parts of New Zealand, some apiarists who have been keeping bees for ten years or more never having seen it. Other districts that have in the past been troubled with the disease are now free from any sign of infection.

There is therefore no excuse for the presence of foul-brood in apiaries situated in open country: its presence is explained by carelessness on the part of the beekeeper. There is no remedy for American foul-brood superior to the McEvoy treatment, which has been frequently described in the *Journal*, and is more fully dealt with in the Department's Bulletin No. 119, " American Foul-brood in Bees, and its Treatment," which can be obtained free on application. Carelessness in dealing with foul-brood must result in heavy losses, and eventually in the destruction of the whole apiary. Make a point of treating any colonies found to be infected; though there may be only a few cells of disease showing, the infection is there, and it is not safe to trust to any methods less than the full McEvoy treatment. On no account put supers on infected colonies ; this will only increase the quantity of material that must eventually be destroyed to ensure the eradication of the disease.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Vegetable Crops.

The climatic advantages of warm districts for growing these crops are generally recognized, and in the production of early crops they are sometimes very considerable. For many of the main crops and winter crops, however, they are often at a distinct disadvantage. Some of these thrive best in a cool district, and under such conditions insect pests are not so prevalent. In such localities certified seed potatoes may often be grown : swedes and late peas are superior, as also are choice savoy cabbage, cauliflowers, and broccoli. Good brussels sprouts can be grown only in the cooler districts. Selected areas on farms are sometimes leased for this class of cropping, and after three years are handed back, sown down in grass and grazed for a similar period before cropping again. The demonstration has been very instructive to those engaged in mixed farming, and such farmers are taking advantage of the excellent prospects thus opened up. The rest afforded by this class of rotation gets rid of many of the pests and diseases affecting these crops, and intensive grazing is probably the best way of building up fertility again under modern conditions. Combined with the liberal use of fertilizers, this method is probably the most economical way of producing crops of the standard hardy vegetables. In fact, in the warmer districts where early crops are grown and followed up by half-hardy summer crops, a rotation along these lines is best, when supplies of stable or farm manure are not available for maintaining the necessary supply of humus in the soil. The alternative in such a case is to sow down the greater part of the area in oats and horse-beans, &c , in the autumn and grow a heavy green crop for turning under. For this class of cropping fairly light land is required, and the maintenance of a sufficient supply of humus in the soil is the crucial problem under present conditions.

Planting winter crops of celery, leeks, savoys, and red cabbage, cauliflower, broccoli, brussels sprouts, and kale should now be completed. Clean strong plants set out in land that is well prepared can generally be relied upon to give a good crop. Weak, blind plants should be avoided ; and a sharp look-out for any sign of club-root should be kept when dealing with those of the cabbage family. Aphides, and caterpillar larvæ of the diamond-back moth, and white butterfly are persistent enemies of plants of that class at the present time. The attack is less severe as soon as autumn rains and temperatures are experienced. Nicotine sulphate and arsenate of lead have been used with some success for protecting crops from these attacks. If, when the plants are lifted, the tops are dipped in this mixture and allowed to dry off before planting, it will destroy these pests ; but for further protection something less volatile than nicotine and less poisonous than arsenate of lead should be used. We now have an excellent remedy in derris. If a good brand of dust is used after planting out at intervals as required, these pests will do little damage. A dust-gun of modern design costs but a few shillings, and with it the dust may be applied economically, efficiently, and with little labour. As a protection from the attack of leaf-spot fungus on celery-plants, a thorough application of Burgundy mixture should be applied just before lifting and planting out.

On light land in cold districts "early" potatoes are sometimes planted late and left in the ground during the winter and lifted as required. In warmer districts, however, where they are now maturing, they should be lifted as soon as they commence to ripen and before the plants die down. Except in the driest districts, crops of late potatoes should now be sprayed with summer strength Bordeaux to protect them from the attack of late blight, and the application repeated at intervals of three or four weeks or as long as may be necessary.

Crops of autumn-sown onions, shallots, and garlic ripen during the month of January. They should then be lifted and thoroughly cured. If the weather is unsettled this is best done under cover; but in any case they should be given good dry storage for a few weeks to thoroughly harden off the bulbs before cleaning and grading.

The leading growth of such crops as pumpkins, marrows, &c, should now be stopped by removing the tips of the leaders with a view to encouraging fruitful lateral growth. Careful attention will be required in supplying water to the celery crop. It is sometimes overdone: much depends on the subsoil and drainage; also the nature of the topsoil and the fertilizers and manures used. Anything like a water-logged condition should be carefully avoided. Spent crops must be cleared promptly. Delay affords a risk of perpetuating disease and exhausts the soil unnecessarily.

Tomato crops under glass will require attention in feeding, watering, and ventilation to fill out the top fruit. Where seeds are being sown for a winter crop to follow on, arrangements should be made for thoroughly disinfecting the house before planting the new crop. The establishment of the tomato-mite pest, *Phyllocoptes* sp., in the Auckland District (fully described in the July number of the *Journal* by Cottier and Taylor), appears to have been often largely due to neglecting to clear the old crop promptly as soon as the fruit was gathered and thoroughly cleansing the house For the control of these mites on the growing crop, also aphides and white-fly, fumigation with nicotine sulphate 1 fluid ounce to each thousand cubic feet of house should be used during a calm evening more frequently Where houses are insufficiently gas-tight for fumigation in this way, spraying with nicotine sulphate may be adopted, mixing one pint in 100 gallons of water in which 3 lb or 4 lb. of soap have been dissolved.

The outside tomato crop in most instances commences to ripen towards the end of January, and when the soil is in nice condition after rain a side dressing of fertilizers will often be of assistance to the plants. Study the crop well and apply a mixture which will best adjust any undesirable bias which may be present as well as stimulate the plants to enable them to mature the crop well. Clean picking is important, as with any other fruit crop—that is to say, all mature fruit should be gathered at one picking; any overlooked are wasted and encourage attack from birds, or, if gathered later, often lead to a pack of mixed maturity being made, which is unsatisfactory to the buyer.

Sowings of peas and dwarf beans are now sometimes made, but it requires a warm climate to finish them well. Shorthorn carrots and globe beet, silver beet, spinach, and salads may be sown. In the cooler districts spring cabbage is sown towards the end of January, but the following month is otherwise soon enough.

Small and Sundry Fruits.

The crops of hardy small fruits are now being harvested. As soon as they are finished plantations of black currants, raspberries, and loganberries, which carried the crop on the young wood, should then have that wood cut out, including weak growths, carefully gathered up, carried out, and burnt. Cut well back to the surface of the ground, or, in the case of currants, to just beyond a bud well down on the branch. The new growth of loganberries running over the surface of the ground is usually best left there until growth commences in the spring, when it may be trained in on the trellis and the ground cleared for the growth of another season. Strawberry-beds which are exhausted should be grubbed out and burnt without delay, and the land prepared for another crop. Where the beds are to be carried on for another season they are cleared of runners, mulch, and weeds; given a dressing of such manures as they require, and light cultivation to build up constitution for the next crop.

The new canes of raspberries and loganberries are now liable to be attacked by the caterpillar larvæ of a native moth known as *Carposina adreptella*, which eats out the buds. They should therefore be protected by applications of arsenate of lead until the month of March, when egg-laying probably ceases. Without this protection the attack often causes serious damage. The article in the October number of the *Journal* by Muggeridge and Cottier, on the black-currant-bud eelworm should be carefully studied and the suggestions under the heading of " general hygienic measures " of control put into practice. The plants should be closely examined in dry weather, and all infected material cut out and burnt. Where infected bushes are found the ammonia-solution spray should be given a trial experimentally. It is made of ordinary ammonia 3 parts to 100 parts of water. When cuttings are made later it is, of course, important to see that all propagating-material is definitely free from this pest, and is kept from any contact with plants or land which may be infected.

Where land has to be prepared for autumn or winter planting of small-fruit, it should now be fallowed to thoroughly clean up all bad weeds, and it is advisable to work in such manures and fertilizers as may be necessary to put it in good heart. In the warmer districts strawberry-plants are set out so late as the month of April, but in most districts they are best planted as soon as the young plants are available, so that they may become established before the cold weather. Where plants of these or other kinds have to be purchased, the stocks should be carefully examined now and suitable material ordered for delivery as soon as it is ready for removal. Plants should be sturdy, but not over-sized and soft, well-rooted, clean, and true to name. The temptation to purchase cheap material should be dealt with cautiously. Unless the plants are sound and the ground thoroughly clean, planting should be deferred to another season. Most of these crops thrive best in the cooler districts, with a good rainfall, unless irrigation can be done.

The Homestead Garden.

The pleasure in a garden is often discounted by the heavy demand or cost of labour in maintenance, and to avoid this difficulty care should be taken now when designing new gardens or alterations to old ones. Maintenance is greatly facilitated if the design is simple in outline and the lawn is not overcrowded with isolated specimens of trees, shrubs, and flower-beds. A little planting on a lawn is often desirable to avoid monotony and give variety. The outstanding position is suitable for displaying a handsome tree which will also afford shade or shelter, or for a bed of flowering plants that is given special attention; but great restraint is necessary both to obtain the best effect as well as to make maintenance easy. Where a mistake of this kind has been made in an established garden, beds may be levelled and turfed down during the autumn, superfluous trees and shrubs removed, and the site consolidated and turfed over. When of moderate size and lifted with care, shrubs may be replanted in a group on the lawn or elsewhere quite successfully. Banks or terraces of any size or if at all steep may be planted closely with shrubs and possibly trees ; or a dry stone wall may be built, thus dispensing with the grassed face altogether.

Where small paddocks in the vicinity of the homestead may be broken up in rotation for cropping with roots and vegetables by means of horse-drawn implements, the ordinary kitchen garden can be dispensed with, merely retaining an enclosed area for small-fruits and such perennial crops as asparagas, rhubarb, and herbs, also salad crops—an area which will require comparatively little labour, and that of the lightest kind, to maintain it in good condition. With a cool dark shed, well ventilated, and a concrete floor to enable it to be kept clean, potatoes, roots, hard fruits, such as apples, &c., may be kept in good condition for a maximum period with a minimum of loss. Such produce as pumpkins and onions will require the drier position. In these and other ways great economies in labour and produce may be made on many farms.

Not the least important feature in the homestead garden is the lawns ; a thick sward, clean, fine, and of good colour is a necessary setting for the best results. Where the land is moist, well drained, and of good quality, there is little trouble in obtaining a high standard in this respect. Otherwise more attention is required ; but it is an interesting problem for one who has much to do with the management of pastures. The treatment of lawns then takes on something in the nature of experimental plots from which much may be learned regarding local reactions, some of which may have an application to the bigger problems on the farm. The main difference between lawns and pastures is that the former are not grazed, and therefore do not receive the manurial dressings the pastures get. Unless the conditions are of the best, the soil fertility soon shows signs of depreciation and the turf becomes open and weedy, especially where close cutting and hard wear takes place. It is then necessary, as with other crops, to practise feeding to maintain a high standard of growth. This usually takes the form of small periodical dressings of fertilizers, and, in the case of light land, an occasional dressing of a compost rich in humus. Where attention of this kind may be necessary, and in the absence of a good local practice to the contrary, the following mixture may be applied towards the end of January at a rate of 1 oz. per square yard, which is equal to about 300 lb. per acre : 3 parts superphosphate and 4 parts nitrate of soda. The materials should be well mixed, and if a quantity of dry light-screened loam is included it will often facilitate an even distribution being made. It should be applied after rain when the grass is dry.

Where black wattle and eucalypts are grown for shelter and firewood, cutting demands careful consideration. It has been stated that black wattle cut in summer will renew itself very effectively. Eucalypts also will make good second growth, which is useful for shelter and other purposes, if they are properly cut at the right season : this has been stated to be the late winter for preference. It is possible these reactions may vary in different localities, and these treatments require a trial under various local conditions. In most instances it is probable that late in the months of January and July would generally be most suitable for cutting these trees, and they should be sawn off about level with the ground so that new growths will get support and will not readily be blown out.

—*Wm. C. Hyde, Horticulturist, Wellington.*

ESTIMATED AREAS UNDER WHEAT, OATS, BARLEY, AND POTATOES (SEASON 1937–38).

As in previous years, cards were sent out by post to grain-growers and to potato-growers throughout the Dominion asking them to state what areas they had sown or planted, or intended to sow or plant, in wheat, oats, barley, and potatoes this season. It may be well to note that only holdings of 1 acre and over outside borough boundaries are covered by the figures appearing below. In the case of potatoes a fair amount is undoubtedly grown on the smaller holdings and on holdings situated within boroughs.

WHEAT, OATS, AND BARLEY.—FINAL AREAS, 1936–37, AND AREAS ESTIMATED AS SOWN OR TO BE SOWN IN 1937–38.

—	Wheat.	Oats.	Barley.
	Acres.	Acres.	Acres.
Areas, 1936–37 :—			
For threshing	221,790	74,772	20,544
For chaffing	1,400	187,694	694
Total harvested	223,190	262,466	21,238
Not harvested (fed off, &c.) .	1,447	53,238	4,274
Grand totals	224,637	315,704	25,512
Areas, 1937–38 (estimated) :—			
North Island	3,300	16,500	3,200
South Island	184,700	269,100	27,300
Totals	188,000	285,600	30,500

Particulars as to varieties of wheat and oats sown or intended to be sown were asked for. The following table gives a summary of results in cases where varieties were specified :—

—	Wheat.				Oats.				
	Tuscan or Longberry.	Hunters (Varieties).	Velvet or Pearl.	Total Specified Varieties.	White.	Dun.	Black.	Algerian	Total Specified Varieties.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Island	930	599	528	2,057	902	62	86	5,476	6,526
Nelson, Marlborough, and Westland	2,469	1,371	437	4,277	294	273	123	6,939	7,629
Canterbury	102,566	23,978	3,366	129,910	50,185	12,277	4,801	44,420	111,683
Otago and Southland ..	9,633	5,429	653	15,715	52,664	3,166	2,838	5,322	63,990
Dominion totals ..	115,598	31,377	4,984	151,959	104,045	15,778	7,848	62,157	189,828

Tabulation of statistics for potatoes gives the following results :—

POTATOES.—FINAL AREA, 1936–37, AND AREA ESTIMATED AS PLANTED OR TO BE PLANTED, 1937–38.

	Final Area, 1936–37.	Estimated Area, 1937–38.
	Acres.	Acres.
North Island	5,812	4,900
South Island	16,650	16,800
Totals for Dominion ..	22,462	21,700

—*Government Statistician.*

WEATHER RECORDS: NOVEMBER, 1937.

Dominion Meteorological Office.

NOTES FOR NOVEMBER.

In most districts November proved a favourable spring month, although the first half was extremely dry and, following a lengthy spell of equally dry conditions, during this period there was a shortage of feed in many parts of the country, and the general outlook for the farming community appeared to be very serious. Between the 15th and 25th, however, beneficial rains occurred at times over the greater portion of the Dominion, and pastures and vegetation revived. In parts of South Canterbury, Otago, and Marlborough, however, the rainfall was not sufficient to relieve the situation, and in these areas food for stock is still short and many crops have been seriously affected. The North Island, on the other hand, with the exception of the Manawatu district, experienced favourable conditions, with the result that feed is now plentiful. On the whole, stock are in good condition and the season has been excellent for the fattening of lambs.

Rainfall.—Over most of the northern half of the North Island the month's aggregate rainfall was above the average, the greatest departure being in North Auckland. The whole of the remainder of the Dominion experienced a deficit, places in the eastern and southern areas of the South Island having less than half the November average.

Temperatures.—Temperatures were everywhere above normal, the departure averaging 2° F. in both Islands. Some days were very warm, but, on the other hand, there were several nights when frosts were severe enough to cause damage to fruit trees and vegetables, more especially at inland places in the South Island.

Sunshine.—The amount of bright sunshine recorded nearly everywhere exceeded the average, the only reporting stations having a deficiency being Nelson and Waimate. Blenheim had 259·7 and Napier 251·8 hours.

Pressure Systems.—During the first week the weather was fine, almost generally under the influence of a rather intense anticyclone, the centre of which moved to the east of the North Island on the 8th. By the 9th a shallow depression had advanced on to the Dominion and fairly general, though mostly light, rains occurred during the night. Rain also fell over most of the North Island between the 11th and 14th associated with a cyclonic depression which crossed northern New Zealand on the latter day. Up to this time rainfall had not been widespread, and the South Island especially had continued to experience dry conditions.

By the 16th, however, an extensive westerly depression had moved on to New Zealand and general beneficial rains accompanied it about this time. A series of similar depressions continued to cross the Dominion until the 19th, and strong and squally winds between north-west and south-west prevailed, with changeable conditions and rain at times in most parts of the country. Thunderstorms were also frequent during this period, particularly severe ones occurring on the 17th in the Waikato district, and on the 19th in parts of Taranaki and Wellington provinces.

The final storm system of the month was a combination of a cyclone in the north and a westerly depression in the south, both of which crossed the Dominion during the night of the 24th. This disturbance deepened considerably in passing to the east, and consequently, during the night of the 24th and on the 25th, strong southerly winds to gales prevailed, accompanied by heavy showers and, in places, thunder and hail. Particularly heavy rains occurred in the Auckland province, and a severe thunderstorm was experienced in parts of the Gisborne district. This was the only really cold snap during the month, and, fortunately, it was of brief durati On the 26th anticyclonic conditions with fine weather set in and continue to the close of the month.

RAINFALLS FOR NOVEMBER, 1937.

Station.	Total Fall.	Wet Days.	Maximum Fall.	Average November Fall.	Total Fall to date.	Average Fall to date.
North Island.						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	4·39	11	1·40	2·75	55·11	51·68
Russell	5·51	8	1·94	3·19	91·98	54·86
Whangarei	4·68	12	1·04	2·81	79·01	57·52
Auckland	3·18	10	1·20	3·59	41·29	46·17
Hamilton	3·00	11	1·74	4·01	35·92	46·04
Rotorua	4·41	11	1·42	4·18	45·12	51·25
Kawhia	..	..	..	4·52	..	50·42
New Plymouth ..	2·90	14	1·13	4·70	50·96	55·49
Riversdale, Inglewood ..	6·15	17	1·71	9·12	80·83	96·69
Whangamomona ..	..	..	..	7·39	..	71·92
Hawera	2·85	10	0·74	3·78	36·15	41·96
Tairua	4·21	8	1·45	3·63	60·86	60·07
Tauranga	3·79	10	1·53	3·29	50·98	48·81
Maraehako Station, Opotiki	4·17	10	1·49	3·16	55·99	50·45
Gisborne	2·52	9	1·01	2·88	37·69	42·83
Taupo	2·67	10	1·56	3·32	29·87	40·75
Napier	1·26	7	0·68	2·02	23·44	28·14
Hastings	1·60	7	0·6[illegible]	1·82	19·67	29·98
Taihape	..	..	..	3·4[illegible]	..	33·46
Masterton	1·66	11	0·59	2·69	29·65	35·47
Patea	3·64	10	0·96	4·01	38·14	41·29
Wanganui	1·97	8	0·93	3·24	27·56	33·42
Foxton	1·66	9	0·50	3·20	20·61	29·87
Wellington	2·90	9	1·31	2·99	30·97	39·37
South Island.						
Westport	7·11	10	2·05	8·85	71·36	88·35
Greymouth	8·48	17	2·22	9·10	85·79	92·90
Hokitika	9·11	15	..	10·45	92·56	104·57
Ross	8·91	14	2·89	13·86	113·02	123·44
Arthur's Pass ..	..	..	..	16·11	..	147·80
Okuru, South Westland	8·78	7	2·60	12·60	125·25	133·50
Collingwood	4·73	8	2·29	6·90	68·48	89·19
Nelson	2·65	7	0·99	2·92	28·15	34·86
Spring Creek, Blenheim	1·85	6	0·80	23·9	22·26	28·18
Seddon	1·14	5	0·56	1·85	21·41	22·84
Hanmer Springs ..	1·17	10	0·25	3·46	29·78	41·29
Highfield, Waiau ..	1·03	7	0·35	2·52	20·10	30·64
Gore Bay	1·96	7	0·64	2·12	27·97	28·70
Christchurch	0·88	9	0·31	1·78	19·46	22·67
Timaru	0·73	5	0·38	1·95	17·09	20·26
Lambrook Station, Fairlie	1·09	5	0·39	1·93	15·74	22·30
Benmore Station, Clearburn	0·47	6	0·23	2·05	20·45	22·30
Oamaru	0·46	5	0·29	1·92	13·68	19·76
Queenstown	0·33	4	0·14	2·71	21·71	27·99
Clyde	0·58	3	0·33	1·34	12·26	13·46
Dunedin	1·14	7	0·36	3·21	34·19	33·18
Wendon	1·55	9	0·49	2·72	35·19	27·14
Balclutha	1·20	6	0·43	2·48	27·86	23·06
Invercargill	2·61	17	1·00	4·28	36·77	41·65
Puysegur Point ..	6·27	22	1·61	8·25	76·11	78·09
Half-moon Bay ..	3·04	16	0·78	5·79	51·11	53·89

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